Queen's University

KINGSTON, CANADA

CALENDAR

OF

THE FACULTY OF APPLIED SCIENCE

(SCHOOL OF MINING)

THIRTY-FIRST SESSION

1923-1924

Attention is directed to the following regulations:—

Re compulsory supplemental examinations.

Re back classes.

Re September examinations at outside centres.

Re date of application for September examinations.

Re changes in Courses.

Queen's University

KINGSTON, CANADA

CALENDAR

OF

THE FACULTY OF APPLIED SCIENCE

(SCHOOL OF MINING)

THIRTY-FIRST SESSION

1923-1924

KINGSTON
PRINTED FOR THE UNIVERSITY BY THE BRITISH WHIG
1923

CALENDAR

1923

JANUARY

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1924

JANUARY

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MARCH

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JULY

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OCTOBER

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NOVEMBER

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DECEMBER

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CALENDAR

1923

Aug. 1, Wednesday—Last day for applying for September examination at the University or outside centres; or for exemption from these examinations under regulation page

Aug. 31, Friday—Shop Work for Courses F and G begins.

Sept. 17, Monday—Supplemental Pass Examinations begin.

Sept. 25, Tuesday—Registration of First Year Students.

Sept. 26, Wednesday—Classes of First Year open at 8 a.m.

Sept. 26, Wednesday—Registration of Second, Third and Fourth Years.

Sept. 27, Thursday—Classes of Second, Third and Fourth Years open at 8 a.m.

Oct. 5, Friday—Last day of registration with extra fee of students in Applied Science who have not previously obtained from the Faculty permission to register later.

Dec. 21, Friday—Christmas holidays begin at 5 p.m.

1924.

Jan. 7, Monday—Classes re-open (2nd term) at 8 a.m.

Jan. 14, Monday—Mid-year examinations begin.

March 5, Wednesday—Holiday, (Ash Wednesday).

March 15, Saturday—Last day for receiving applications and fees for graduation.

April 1, Tuesday—Last day for receiving manuscripts and essays for prizes.

April 16, Wednesday—Classes close at 5 p.m.

April 17, Thursday—Examinations begin.

April 18, Friday—Holiday (Good Friday).

April 24, Thursday—Last day for receiving fees for Engineering Field Work I.

May 5, Monday—Meeting of Faculty to consider reports of examiners.

May 7, Wednesday—Convocation for distributing prizes, announcing honours and conferring degrees.

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Very Rev. D. M. Gordon, D.D., LL.D., C.M.G.

RECTOR

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John Watson, M.A., LL.D., D.D., D.Litt.

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W. E. McNeill, M.A., Ph.D.

DEPUTY REGISTRAR

Alice King.

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R. Bruce Taylor, M.A., D.D., LL.D. ..... Principal

A. E. Ross, M.D., LL.D., M.P., C.M.G. .....Rector

Elective Members

Retire 1923

Rev. D. R. Drummond, M.A., D.D.[6] ..... Hamilton
Hon. A. C. Hardy.[6] ..... Brockville
A. J. Meiklejohn, B. A.[6] ..... Montreal, Que.

Retire 1924

R. Crawford, B.A.[4] ..... Kingston
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Very Rev. W. T. Herridge, D.D.[6] ..... Ottawa
A. P. Knight, M.A., M.D., F.R.S.C.[2] ..... Kingston
Judge H. A. Lavell, B.A.[3] ..... Kingston
Hon. Mr. Justice W. A. Logie, M.A., LL.B.[6] ..... Toronto
J. A. Minnes, Esq.[1] ..... Kingston
Hon. Mr. Justice H. M. Mowat, B.A., LL.B.[1] ..... Toronto
M. J. O'Brien, Esq.[4] ..... Renfrew
James Richardson, Esq[6] ..... Winnipeg, Man
Sir J. S. Willison, LL.D.[3] ..... Toronto

Retire 1925

H. A. Calvin, Esq.,[2] ..... Kingston
James Cappon, M.A., LL.D., F.R.S.C.[3] ..... Kingston
J. M. Farrell, B.A.[3] ..... Kingston
R. E. Kent, Esq.[4] ..... Kingston
Alexander Longwell, B.A., B.Sc.[1] ..... Toronto
D. M. McIntyre, LL.D., K.C.[1] ..... Toronto
Very Rev. M. Macgillivray, M.A., D.D.[6] ..... Kingston
R. A. Stapells, Esq.[6] ..... Toronto

Retire 1926.

Hamilton Cassels, K.C., LL.D.[6] ..... Toronto
Very Rev. D. M. Gordon, D.D., LL.D., C.M.G.[2] ..... Kingston
Andrew Haydon, M.A.[6] ..... Ottawa
G. F. Henderson, B.A., K.C.[2] ..... Ottawa
J. G. Macphail, B.A., B.Sc.[3] ..... Ottawa
W. G. Miller, B. A. LL.D.[7] ..... Toronto
W. F. Nickle, K. C.[1] ..... Kingston
W. H. Rankin, M.D. ..... Brooklyn, N.Y.
E. R. Peacock, M.A.[6] ..... London, Eng.
A. Shortt, M.A., LL.D., C.M.G.[3] ..... Ottawa

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[1]Elected by the University Council.
[2]Elected by the Benefactors.
[3]Elected by the Graduates.
[4]Elected by the Board of Trustees to represent the Faculty of Applied Science.
[5]Elected by the Faculty of Queen's Theological College.
[6]Elected by the Board of Trustees from among its own members.
[7]Elected by the Benefactors to represent the Faculty of Applied Science.

THE UNIVERSITY COUNCIL

Registrar

J. M. Farrell, B.A.

Ex-officio Members

The Chancellor
The Principal
The Members of the Board of Trustees
The Members of the Senate

Elective Members

Retire 1924.

E. A. Collins, B.Sc. ..... Copper Cliff
Rev. Eber Crummy, B.Sc., D.D. ..... Red Deer, Alta.
Arthur B. Cunningham, B.A. ..... Kingston
A. J. Meiklejohn, B.A. ..... Montreal
James A. Minnes, Esq. ..... Kingston
R. S. Minnes, M.A., M.D. ..... Ottawa
Miss Marion Redden, B.A. ..... Kingston
R. O. Sweezey, B.Sc. ..... Montreal

Retire 1925

Rev. J. A. Donnell, M.A. ..... Saskatoon, Sask.
John Donnelly, E.M. ..... Kingston
W C. Dowsley, M.A. ..... Brockville
Mrs. H. A. Lavell, B.A. ..... Kingston
Hon. Mr. Justice H. M. Mowat, B.A., LL.B., K.C. ..... Toronto
F. J. Pope, M.A., Ph.D. ..... New Rochelle, N. Y.
Jas. Wallace, M.A. M.D. ..... Cambridge, Mass.

Retire 1926.

H. A. Calvin, Esq. ..... Kingston
E. T. Corkill, B.Sc., M.E. ..... Copper Cliff
Principal W. L. Grant, M.A. ..... Toronto
Judge A. G. Farrell, B.A. ..... Regina, Sask.
Miss Edna Poole, B.A. ..... Toronto
A. Longwell, B.A., B.Sc. ..... Toronto
C. F. Hamilton, M.A. ..... Ottawa
Rev. J. W. McIntosh, M.A. ..... Prince Albert

Retire 1927

Rev. James Binnie, M.A., B.D. ..... Parry Sound
H. W. Bryan, M.A., ... Renfrew
D. D. Calvin, B.A. ..... Toronto
T. H. Farrell, M.A., M.D. .....Utica, N.Y.
A. Haydon, M.A., LL.B. ..... Ottawa
Francis King, M.A., K.C. ..... Kingston
D. H. Laird, M.A., K.C. ..... Winnipeg, Man.
W. F. Nickle, B.A., K.C., M.P.P. ..... Kingston
Miss Victoria Reid, B.A., M.D. ..... Toronto

Retire 1928.

J. M. Macdonnell, M.A. ..... Montreal, Que.
C. Laidlaw, B.A., M.D. ..... Ottawa
R. W. Brock, M.A. .....Vancouver
Judge E. B. Fraleck, B.A. .....Belleville
Rev. D. McTavish, M.A., D.Sc.....Toronto
E. J. Williams, B.A., M.D. .....Brockville
W. H. Rankin, M.D. ..... Brooklyn, N. Y.
R. H. Cowley, M.A. .....Toronto

Retire 1929.

F. Etherington, M.D., C.M.G. ..... Kingston, Ont.
Geo. A. Guess, M.A. ..... Kingston, Ont
Dennis Jordan, B.A., M.D..... Toronto, Ont.
Rev. Neil M. Leckie, M.A..... St. Mary's, Ont.
W. S. Morden, B.A., LL.D..... Toronto, Ont.
Mrs. J. Macgillivray, M.A. ..... Kingston, Ont.
D. M. McIntyre, M.A., K.C..... Toronto, Ont.
Rev. J. H. Turnbull, M.A..... Toronto, Ont.

THE SENATE.

Ex-officio Members

R. Bruce Taylor, M.A., D.D., LL.D. ..... Principal
John Watson, M.A., D.D., LL.D. ..... Vice-Principal
Oscar D. Skelton, M.A., Ph.D. ..... Dean of the Faculty of Arts
A. L. Clark, B.Sc., Ph.D. .....Dean of the Faculty of Applied Science
J. C. Connell, M.A., M.D. ..... Dean of the Faculty of Medicine
Rev. S. W. Dyde, M.A., D.Sc...Principal of Queen's Theological College

Elective Members

The Faculty of Arts

R. O. Jolliffe, M.A., Ph.D. ..... Retires 1925
D. A. McArthur, M.A. ..... Retires 1926
W. T. MacClement, M.A., D.Sc. ..... Retires 1924

The Faculty of Applied Science

W. P. Wilgar, B.Sc. ..... Retires 1924
L. M. Arkley, M.Sc. ..... Retires 1925
S. N. Graham, B.Sc. ..... Retires 1926

The Faculty of Medicine

G. Spencer Melvin, M.D. ..... Retires 1924
J. F. Sparks, M.A., M.D. ..... Retires 1924
G. B. Reed, M.A., Ph.D. ..... Retires 1924

The Faculty of Queen's Theological College.

Rev. W. G. Jordan, B.A., D.D. ..... Retires 1924
Rev. W. Morgan, M.A., D.D. ..... Retires 1925

OFFICERS OF INSTRUCTION

I.—EMERITUS PROFESSORS

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Emeritus Professor of Physics,
Union Street

Wm. Nicol, M.A.,
Emeritus Professor of Mineralogy,
203 Albert Street

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Emeritus Professor of Metallurgy,
Ottawa

W. L. Goodwin, B.Sc., D.Sc., F.R.S.C.
Emeritus Professor of Chemistry.
Toronto

II.—IN THE FACULTY OF APPLIED SCIENCE

A. L. Clark, B.Sc., Ph.D., F.R.S.C.
Professor of Physics and Dean of the Faculty.
200 Albert Street

J. Macgillivray, B.A., Ph.D.
Professor of German Languages and Literature.
96 Albert Street

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138 Albert Street

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45 William Street

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Alice Street

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1 Mack Street

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401 Earl Street

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142 Lower Albert Street

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Professor of Chemistry,
85 Wellington Street

A. L. HUGHES, B.A., D.Sc.
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311 King Street W.

E. L. BRUCE, B.A., B.Sc., Ph.D.,
Professor of Mineralogy,
Queen's University

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Professor of Mechanical Engineering,
Kensington Avenue

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Professor of Mining Engineering,
195 Centre Street

W. C. BAKER, M.A.
Professor of Experimental Physics,
135 Centre Street

J. F. Macdonald, M.A.
Professor of English,
175 Stuart Street

L. Malcolm, M.A., B.Sc., O.L.S., D.L.S.,
Professor of Municipal Engineering,
167 Collingwood Street

J. H. Brovedani, Docteur ès Lettres,
Professor of Italian and Spanish,
22 Division Street

C. F. Gummer, M.A.,
Professor of Mathematics,
143 Collingwood Street

D. M. Jemmett, M.A., B.Sc.,
Professor of Electrical Engineering,
61 Kensington Avenue

J. K. Robertson, M.A.,
Associate Professor of Physics,
105 Albert Street

D. S. Ellis, M.A., B.Sc., O.L.S., D.L.S.,
Associate Professor of Civil Engineering,
Queen Street Apartments

N. Miller, M.A., Ph.D.
Associate Professor of Mathematics,
Edgehill Avenue

J. A. McRae, M.A., F.I.C.,
Associate Professor of Chemistry,
117 William Street

E. Flammer, B.Sc., Ph.D.,
Assistant Professor of Physics,
55 Lower Alfred Street

W. M. Conacher, B.A.,
Assistant Professor of French,
Queen's University

L. T. Rutledge, B.A.Sc.,
Associate Professor of Mechanical Engineering,
262 University Avenue

K. P. Johnston, B.A., B.Sc.,
Assistant Professor of Mathematics,
213 Queen Street

A. Jackson, B.Sc.,
Assistant Professor of Draughting,
Collingwood Street

B. Rose, B.Sc., Ph.D.,
Assistant Professor in Geology and Mineralogy,
Queen's University

A. F. G. Cadenhead, B.A.,
Lecturer in Chemistry,
Alice Street

R. L. Dorrance,, B.A.,
Lecturer in Chemistry,
187 Johnston Street

W. V. Ball, B.A.Sc.
Lecturer in Physics,
Queen's University

J. W. Bain, B.Sc.,
Lecturer in Electrical Engineering,
Queen's University

INSTRUCTORS.

Instructor in Draughting: E. W. Skinner.
Instructor in Shop Work: A. C. Baiden.
Instructor in Blacksmithing: W. E. Connolly.

STUDENT DEMONSTRATORS AND ASSISTANTS

Physics: G. W. Hudson, B. Sc.
Mining and Metallurgy: B. J. Walsh, B.Sc.
Mechanical Engineering: R. J. Clench.
Chemical Engineering: R. G. Corneil, H. B. MacGregor.
Electrical Engineering: D. G. Geiger, W. K. Detlor, S. V. Perry
P. H. McAuley, A. C. Monteith.

DOUGLAS TUTORS

R. J. Askin, C. S. Cassan, G. D. Furse, H. B. Hanna, G. Hyland, S. V. Perry, L. E. R. Stephens, A. S. Townshend, E. T. Wagar.

GOVERNMENT AND ADMINISTRATION

The administration of the University is vested in the Board of Trustees, the University Council, the Senate, and the Faculty Boards.

THE BOARD OF TRUSTEES

The Board of Trustees consists of *ex-officio* and elective members. The former are the Chancellor, the Principal and the Rector. The latter consists of (1) one representative from each affiliated college, (2) repre-

sentatives as provided for by the Statutes from (*a*) the University Council, (*b*)the Benefactors; (*c*) the Graduates, and (3) members elected by the Board of Trustees.

The functions of the Board of Trustees are to manage the finances, to possess and care for the property, to procure legislation, to appoint instructors and other officers, and in general to attend to such external matters as do not relate directly to instruction.

THE UNIVERSITY COUNCIL

The University Council consists of the Chancellor, the Trustees, the members of the Senate, and an equal number of members—graduates or alumni—elected by the graduates.

The Chancellor is elected by the Council, except when two or more candidates are nominated, in which case the election is by registered graduates and alumni. He holds office for three years; and, as the highest officer of the University, presides at meetings of the Council, at Convocation and at statutory meetings of the Senate. In his absence he is represented by the Vice-Chancellor.

The Functions of the Council are:

(1) To elect six trustees, two of whom shall retire annually.

(2) To make by-laws governing the election of (*a*) the Rector by the registered students, (*b*) four trustees by the benefactors, (*c*) six trustees by the University Council, and (*d*) six trustees by the graduates.

(3) To discuss all questions relating to the University and its welfare.

(4) To make representation of its views to the Senate or the Board of Trustees.

(5) To decide on proposals for affiliation.

(6) To arrange all matters pertaining to (*a*) its own meetings and business, (*b*) the meetings and proceedings of Convocation, (*c*) the installation of the Chancellor, and (*d*) the fees for membership, registration, and voting.

The annual meeting of the Council is held on the Tuesday immediately preceding Convocation.

THE SENATE

Until 1913 the Senate was composed of all the Professors, Associate Professors, and Assistant Professors on the staff of the University. It

transacted all business relating to the work of instruction, the arrangement of classes, the conduct of examinations, and the award of standing, having charge in general of the internal administration of the University.

In 1913, however, Faculty Boards were created to relieve the Senate of much work which, owing to the growth of the University, had increasingly devolved upon it, and at the same time the Senate was made a representative body composed of certain members of the various Faculties.

The Senate now consists of:
The Principal.
The Vice-Principal.
The Principal of Queen's Theological College.
The Dean of the Faculty of Arts.
The Dean of the Faculty of Applied Science.
The Dean of the Faculty of Education.
Three Professors elected by the Faculty of Arts.
Two Professors elected by the Faculty of Queen's Theological College.
Three Professors elected by the Faculty of Medicine.
Three Professors elected by the Faculty of Applied Science.

The Functions of the Senate are:

(1) To determine all matters of an academic character which concern the University as a whole.

(2) To consider and determine all courses of study leading to a degree, including conditions of Matriculation, on recommendation of the respective Faculty Boards; but the Senate shall not embody any changes without having previously presented these to the Faculty.

(3) To recommend to the Board of Trustees the establishment of any additional Faculty, Department, Chair, or Course of Instruction in the University.

(4) To be the medium of communication between the Alma Mater Society and the Governing Bodies.

(5) To determine all regulations regarding the social functions of the students within the University, and regarding the University Library and University Reading Rooms.

(6) To publish the University Calendar.

(7) To conduct examinations.

(8) To grant Degrees.

(9) To award University Scholarships, Medals and Prizes.

(10) To enforce the Statutes, Rules and Ordinances of the University.

(11) And generally, to make such recommendations to the Governing Boards as may be deemed expedient for promoting the interests of the University.

THE FACULTY BOARDS

The Faculty Boards are constituted as follows:

For the Faculty of Arts and for the Faculty of Applied Science, the Dean, Professors, Associate Professors, Assistant Professors, and Lecturers of each Faculty have power to meet as separate boards, and to administer the affairs of each Faculty under such regulations as the Board of Trustees may prescribe.

For the Faculty of Medicine, the Dean, Professors, Associate Professors, and Assistant Professors have power to meet as a separate board, and to administer the affairs of the Faculty under such regulations as the Board of Trustees may prescribe

The principal is *ex-officio* president and a member of each of the foregoing Faculty Boards. In his absence from the Arts Faculty the Vice-Principal shall preside. In his absence from the Medical Faculty, or from the Faculty of Applied Science, the Dean of the Faculty shall preside.

The Functions of the Faculty Boards are:

(1) To recommend to the Senate courses of study leading to a degree, and the conditions of admission.

(2) To decide upon applications for admission or for change of course, subject to the regulations of the Senate.

(3) To submit to the Senate names for both ordinary and honorary degrees.

(4) To arrange the time-table for classes and to edit the Faculty Calendar, subject to the approval of the Senate.

(5) To control registration, and determine the amount of fees and manner of payment, subject to the regulations of the Senate.

(6) To deal with class failures.

(7) To exercise academic supervision over students.

(8) To make such recommendations to the Senate as may be deemed expedient for promoting the efficiency of the University.

(9) To award Faculty Scholarships, Medals and Prizes.

(10) To appoint such sessional assistants, fellows, tutors and demonstrators as shall be needed to give instruction in the subjects taught by the Faculty.

(11) To pass such regulations and by-laws as may be necessary for the exercise of the functions of the Faculty.

HISTORICAL NOTE.

The School of Mining, now the Faculty of Applied Science, Queen's University, was founded in 1893 under an Ontario Charter which placed its management in the hands of a Board of Governors elected by its shareholders, i.e., the subscribers to its funds. While originally a Mining School it has been expanded to include courses of study for degrees in mining and metallurgy, in civil, mechanical, electrical and chemical engineering, in analytical chemistry and assaying, and in geology and mineralogy. The objects of the institution were to provide thorough instruction both theoretical and practical, in the above and other branches of applied science, and to adapt courses of study and methods of presentation to the conditions prevailing in Canada, so as to secure as nearly as may be a maximum usefulness to the country.

For several sessions all its Departments were housed in Carruthers Science Hall, which had been erected in 1889, but in view of the rapid success and increased requirements of the School, the Provincial Legislature in 1900 provided for its accommodation two large buildings, Ontario Hall for the Departments of Mineralogy, Geology and Physics, and Fleming Hall for the Departments of Civil, Mechanical and Electrical Engineering. More recently the Provincial Government erected Gordon Hall, which is entirely devoted to Chemistry; and, through the generosity of Professor Nicol and other graduates, Nicol Hall has been built for the accommodation of the class rooms and laboratories of the Department of Mining and Metallurgy. These changes permitted the Civil Engineering Department to move into Carruthers Hall, leaving room in Fleming Hall for the already overcrowded departments of Electrical and Mechanical Engineering.

From its inception the School of Mining was closely connected with the University. The students of the School of Mining received their degrees from the University and the graduates in Science enjoyed the same rank and privilege as other graduates in representation upon the University Council and in the election of University Trustees. The staff of the School of Mining constituted practically the Science Faculty of the

University, some of its members being actively connected also with the Arts and Medical Faculties, and the Faculty being represented with other faculties on the Senate of the University.

The School of Mining was formerly under the control of a separate board of Governors, but in the year 1916 it became the Faculty of Applied Science of Queen's University.

Kingston is well situated as the seat of a college of engineering and applied science. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education and also important in other scientific professions, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined *in situ*. In a few hours a class of students can be taken by carriage to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There are several geological formations out-cropping within easy walking distance of the city. If to this be added the accessibility by a short railway journey, of mines in operation, it will be seen the opportunities for instructive demonstrations to classes in mineralogy, geology and mining are very numerous. The metallurgical works at Deloro, eighty miles from Kingston, are also open to our students. It is thus possible to give to the study of mineralogy, geology, mining and metallurgy, that practical turn which not only adds interest to the college course, but shortens the period between graduation and attainment of proficiency and confidence in professional work.

The variety of topographical features in the surrounding country affords the best of material for practice in all branches of surveying, including railway, topographic, hydrographic and land surveying. The main line of the Grand Trunk passes through Kingston, which is also a terminus of branches of the Canadian Pacific and Canadian Northern Railways. The Canadian Locomotive Works, which are the largest locomotive shops in Ontario, are within ten minutes' walk of the University, and are open to students for study and for assisting in engine testing and similar work. Kingston has two Dry Docks, one of which, the large Dominion Government Dock, is now under lease to the Kingston Ship Building Co., in whose yards steel construction can be practically studied. The locks of the Rideau Canal can be visited at Kingston Mills, six miles from the heart of the city. There are also several water powers within easy distance, some of which are as yet awaiting development, while others can be seen in use at Gananoque (eighteen miles distant), at Trenton (sixty miles distant), and at other points. Students of civil, mechanical and electrical engineering thus have easy access to practical illustrations of their professional studies.

REQUIREMENTS FOR ADMISSION.

Candidates desiring to enter the Faculty of Applied Science should under no circumstances come to the University without having first submitted their certificates to the Registrar for a statement regarding their value. Certificates should be in the Registrar's hands not later than September 10.

I.—ADMISSION BY MATRICULATION.

The requirements for matriculation into the Faculty of Applied Science are as follows:

Part I. Pass Matriculation in the following subjects: *English, Mathematics, British History, and any two of the following: Latin, Greek, French, German, Spanish and Experimental Science (Physics and Chemistry).*

Part II. Honour Matriculation in the following subjects: *English, Mathematics,* and either a *Language* or *Experimental Science.*

The pass standard is fifty per cent on each paper on both Pass and Honour Matriculation.

Note:—For Honour Matriculation in a Language or Experimental Science a candidate may substitute Pass Matriculation in one of the optional subjects not offered in connection with Part I.

Candidates who are eligible to enter the Faculty of Arts but have not passed in the exact subjects required for the Faculty of Applied Science may prepare for a B.Sc., course, by taking a specified year's work in the Arts Faculty, which shall include English 1, Mathematics 1, History 1 or 3, Biology 1, French A, or Latin A, (or French 1 or Latin 1.)

Candidates having only Pass Matriculation as defined in Part I above will be admitted to this preliminary year in the Faculty of Arts if they declare their intention of entering the Faculty of Applied Science when their matriculation conditions are removed.

The requirements of Part II above may be satisfied by correspondence work in the Arts Faculty if the language option is taken.

By special permission of the Senate and upon the recommendation of the Science Faculty, students over twenty-one years of age may be admitted to this preliminary year in Arts for the purpose of satisfying the Science Matriculation requirements.

II.—ADMISSION BY EQUIVALENT EXAMINATION.

The following certificates are accepted for Pass Matriculation, (Part I), in the subjects which they cover.

Alberta	Grade XI.
British Columbia	Intermediate Grade with Science of Senior Grade.
Manitoba	Grade XI Engineering Matriculation.
New Brunswick	Class I.
Nova Scotia	Grade XI.
Prince Edward Island	First Class Teachers' License or Second Year Certificates from Prince of Wales' College.
Saskatchewan	Middle Form.
Quebec	Academy Grade III. University School Leaving Certificate.

Any one of the following certificates will be accepted in place of Honour Matriculation if the required standing has been made in the subjects covered.

Alberta	Grade XII.
British Columbia	Senior Grade.
Manitoba	First Class.
New Brunswick	Grammar School.
Newfoundland	Associate Grade.
Nova Scotia	Grade XII (50% required).
Ontario	Entrance to Faculty of Education.
Prince Edward Island	Honour Diploma of Third Year, Prince of Wales College.
Saskatchewan	First Class.

NOTE.—A certificate from any school which is on the list of schools approved by any University or Technical College of recognized standing in the United States will be accepted as equivalent to matriculation examination *pro tanto*.

Graduates of schools especially approved by the University are admitted, without condition, on the certificate of the Head Master.

Candidates from Technical Schools should send to the Registrar a detailed statement regarding their course in order to learn the conditions of admission.

III.—ADMISSION TO ADVANCED STANDING.

A student who has already taken, in a University Arts or Science Faculty or in a recognized technical or military school, subjects included in a course in the Faculty of Applied Science will, on entering upon a course for the degree of B.Sc., be admitted to the year for which he is qualified.

A candidate for advanced standing must submit with his application a Calendar of the institution in which he has studied together with an official statement of the subjects passed and the standing made.

IV.—ADMISSION OF SPECIAL STUDENTS.

Students not proceeding to a degree may take any classes for which they are prepared. The work in all classes is so arranged that those who wish to study, either for scientific interest or for the improvement of their qualifications for any particular position, may profitably pursue their studies in the Faculty of Applied Science.

The Faculty will admit under this paragraph, as special students, only such candidates as are fitted to take part of the classes of a course. It will not admit as special students those whom, on account of previous poor records, it is no longer desirable to continue as regular students.

Prospective students under this section should correspond with the Dean of the Faculty of Applied Science in regard to the arrangement of such a course.

MEDAL.

The Governor-General's medal is awarded each year to the student of the graduating class making the highest standing in the third and fourth years. A candidate to be eligible must write on all the examinations of the fourth year.

SCHOLARSHIPS AND PRIZES

Exhibition of 1851 Science Research Scholarship.

This scholarship, of the annual value of £250 stg., is awarded by Her Majesty's Commissioners for the Exhibition of 1851 to students who have given evidence of capacity for original research, and are under 26 years of age. A given number of scholarships are awarded annually to students in Canada recommended by the Universities approved by the Commissioners.

The nominee must be a British subject, must have been a bona fide student of science for three years, must have been a student of the University for a full year immediately before his nomination, must be a student of the University at the time of his nomination, and must pledge himself not to hold any position of emolument whilst holding the scholarship without special permission from the commissioners. He is recommended to the commissioners by the Senate of the University. The scholarship will be tenable ordinarily for two years and in cases of exceptional merit for three years. The scholar will, in the absence of special circumstances, be required to proceed to a country other than that in which he received his scientific training, and there pursue some investigation likely to promote technical industries or scientific culture. The particular investigation the student proposes to pursue must be stated before a scholarship can be awarded.

Students of the Faculty of Applied Science are eligible for this scholarship.

The 1851 Science Research Scholars from Queen's University are the following:—

Norman R. Carmichael, M.A., 1893-4.
Thomas L. Walker, M.A., 1895-6.
Frederick J. Pope, M.A., 1897-8.
Wm. C. Baker, M.A., 1900-1.
C. W. Dickson, M.A., 1901-2-3.
C. W. Knight, B.Sc., 1904-5.
F. H. MacDougall, M.A., B.Sc., 1905-6.
C. Laidlaw, B.A., M.D.,, 1907-8.
N. L. Bowen, M.A., B.Sc., 1909-10.
Walter A. Bell, B.Sc., 1911-12.
J. R. Tuttle, M.A., 1913-14.
R. C. Cantelo, B.Sc., 1915-16.
D. C. H. Wright, B.Sc., 1921.

REGULATIONS REGARDING FELLOWSHIPS IN THE FACULTY OF APPLIED SCIENCE.

1. Applications for Fellowships will be received by the Registrar up to May 1st. If no appointment is made by that date further applications will be received up to September 1st.

2. Fellows shall be selected and the character of their work shall be determined by the Department concerned in consultation with the Dean. The University reserves the right to dismiss a Fellow whose work is not satisfactory.

3. A student appointed to a Fellowship shall carry on research work for the whole session and embody the results in a thesis. The research may take the form either of independent investigation or of assistance in an investigation carried on by some department. The Fellow may be required to undertake tutorial work not to exceed six hours a week.

4. The income of the Fellowship will be paid in five instalments, of which the last will be paid only after the thesis has been accepted. A candidate for degree at the May Convocation must submit his thesis by April 30. Except by special permission, other Fellows must submit their theses not later than September 20.

The Milton Hersey Fellowship in Chemistry.

This Fellowship of the annual value of $500, has been endowed by Milton L. Hersey, M.Sc., LL.D., of Montreal. It is open to graduates of all universities and technical colleges.

The Kenneth B. Carruthers Scholarships in Mining and Metallurgy—Value $137.50 Each.

Given in memory of Major Kenneth B. Carruthers, B.Sc., who was killed at Passchendale in October, 1917. Two scholarships are awarded annually on the results of third year work, one to the student making the highest standing in Mining and the other to the student making the highest standing in Metallurgy. The scholarships will be tenable in the fourth year.

The P. D. Ross Scholarships.

Two scholarships of the value of $100 and $50 respectively. These scholarships are awarded annually to the students obtaining highest and second highest standing in the subjects common to the courses of the second year.

Robert Bruce Scholarships.

Under provisions of the will of the late Robert Bruce of Quebec the University has established a Scholarship worth about $75 in each of the Faculties of Arts, Applied Science, and Medicine. Until 1948 the award is limited to students of Scottish extraction.

The Scholarship in each Faculty will be awarded at the end of the first year to the student who has made the highest standing on the regular examinations of that year. One third of the value of each Scholarship will be paid to the winner in each of the second, third, and fourth years of his Course provided that he is in attendance in the Faculty in which the award was made.

The Sir Sandford Fleming Practical Science Scholarship.—Value $70.

Given by the late Chancellor of the University, Sir Sandford Fleming, C.E., K.C.M.G., LL.D. Awarded to the student of the Faculty of Applied Science obtaining the highest average on the examinations at the end of the first year.

The N. F. Dupuis Scholarship.—Value $60.

This scholarship has been founded by the graduates as a mark of their appreciation of the long and effective services of Dr. N. F. Dupuis, as Dean of the Faculty and Professor of Mathematics. The scholarship is of the value of $60, and is awarded to the student who makes the highest marks in Mathematics of first year at the April Examinations.

The A. E. Segsworth Prize.—Value $50.

This is a prize founded by R. F. Segsworth, Esq., Toronto, in memory of his brother, A. E. Segsworth, B.A., Ph.D. The prize is awarded to the student of any year who hands in before December 1st the best account of his previous summer's experience in practical underground mining.

The Dr. William Moffat Scholarship.—Value $50.

This scholarship has been founded by Dr. William Moffat, of Utica, and is awarded annually to the student making the highest standing in first year chemistry. The award will be made on combined results of class work and examination and students in both Arts and Science will be eligible.

Prizes of The Canadian Institute of Mining and Metallurgy.

Premiums and prizes at the discretion of the Council, may be given annually for papers read by student-members of the Institute and affiliated students during the year. Any such award shall be made by the Council within three months after the Annual Meeting.

Engineering Society Prizes.

The Engineering Society of Queen's University offers two prizes of $15.00 and $10.00 for the two best papers on scientific subjects, by members of the society. These papers must be read before the society, and five papers, at least, must be presented before the prizes will be awarded. These prizes are open for competition to all students of Engineering.

The Douglas Tutorships.

At the beginning of session 1910-11 a gift from Dr. James Douglas, of New York, led to the establishment of a system by which first year students were tutored by men selected from the senior years. The instruction is given out of class hours and as each tutor gives his whole attention to not more than five students in a period, the result is that of individual teaching.

REGULATIONS

N.B.—Students taking a regular course are subject to all rules and Regulations immediately upon publication, unless otherwise specified.

1. Registration.—Students of first year must register and pay fees on the day before the opening of session. Students of other years will register and pay fees on the first day of session. A student who fails to register at the prescribed time must pay an additional fee of $3.00. No student proceeding to a degree will be allowed to register after the tenth day of the session except by special permission of the Faculty, *which permission must be obtained before the opening of session.*

2. Attendance.—Students are required to attend seven-eighths of class lectures before permission will be given to write on examinations, and seven-eighths of laboratory hours before laboratory work will be certified. Exemption from this rule can be obtained only on application to the Faculty.

3. Courses.—All students must take the subjects required in their courses in conformity with the calendars of their years of attendance. If a student wishes to change his course he must first obtain the permission of the Faculty.

4. Sessional Examinations.—Sessional examinations are held in all the subjects prescribed in the various courses. Forty per cent. is required in each subject for pass standing. In determining a student's standing at a sessional examination, professors are empowered to take into account his entire class record.

Regular students must take the April examinations in all subjects in which they are registered and in which such examinations are held. Failure in more than four classes, including practical classes in which no written examinations are held, involves the loss of the session. A student failing in not more than four classes is given supplemental examinations in the following September; if he fails in more than one of these examinations he must repeat the whole work of the year except those subjects in which his standing is second division (55 p.c.) or higher. If a student repeating the work of any year fails in classes enough to involve the loss of the year he must withdraw. A student shall not enter the third year until he has passed all the examinations of the first year; nor the fourth year until he has passed all the examinations of the second year. Engineering Field Work I. is regarded as a second year class and comes under this regulation both in respect to back classes and to admission to the fourth year. A student who is debarred from entering the third year because of back classes in the first year, or from entering the fourth year because of back classes in the second year, shall not be allowed to write on subsequent examinations in these classes without special permission from Faculty.

5. Mid-Session Examinations.—Examinations are held for first year students the second week after Christmas vacation. Any student failing in more than three of these examinations is refused admission in the following spring term, a proper refund being made on fees paid.

Examinations in all classes of the second year are held during the second week after Christmas vacation. Every second year student must write the examination in each class which he attends. The marks given in these examinations will count 25 per cent. of the total for the year.

Examinations, which are duly announced, are held in certain subjects of other years. The marks for these examinations may amount to as much as 25 per cent. of the total for the year.

The Mid-year examination in all subjects in which the instruction terminates at that time are final examinations, and no other papers will be set in these subjects until the following September.

Supplemental Examinations.—Unless specially excused by the Faculty, upon application received at the Registrar's office before August 1st, all students who fail in one or more subjects of their year must write supplemental examinations in all such subjects in September of the same year as a condition of admission to the next higher year of their course.

Students may write on September examinations at approved outside centres but application must be made by August 1st to the Registrar.

6. Practical Work.—Students are required to take the practical courses given in the calendar unless they have followed similar courses in other educational institutions, but instructors may, at their discretion, modify the work in the case of students who have had experience in the field, in engineering works, etc. Such students may be set immediately at more advanced work than that required of those who have not had such experience.

7. Excursions.—The excursions are compulsory for all fourth year students in courses A. D. E. F. and G., and third year students in course B.

8. Vacation Work.—Before applying for a degree a candidate is required to submit certificates of having had at least six months' employment of a nature that in the opinion of the departments concerned shall have given him suitable experience in the practice of his profession.

9. Graduation.—Applications for degree must be made before March 15 on forms supplied by the Registrar.

10. Graduation with Honours.—Honour standing will be given to any student who graduates with an average of seventy-two per cent. or upwards upon the whole of the fourth year work in his course. Credit for Honour standing will be given on the diploma and in the list of graduates a mark of distinction will be placed with the names of those graduating with Honour standing.

11. Fees.—All fees are payable to the University Treasurer. See paragraph 1 under Regulations.

Full Fees For a Course.

Students will pay upon registration the Tuition Fees indicated below for the year of their Course and in addition the charges for Deposit and Student Interests. When fees are paid in instalments, the first payment must be increased by the amount of the deposit required.

Tuition (including class fees, registration, and January and April Examinations).

First Year.

If paid in full on the first day of session	102 00
If paid in instalments:	
1st payment, on or before September 25	60 00
2nd payment, on or before January 8	50 00

Second Year.

If paid in full on the first day of session	112 00
If paid in instalments:	
1st payment, on or before September 26	65 00
2nd payment, on or before January 8	55 00

Third and Fourth Years.

If paid in full on the first day of session	122 00
If paid in instalments:	
1st payment, on or before September 26	70 00
2nd payment, on or before January 8	60 00

Fifth Year in Commerce.

If paid in full by September 26	54 00

Deposit (see Regulation 12 below) .....$5 to $10

Student Interests—(Health insurance, $3; Athletics, $5; Special Fee for Athletics, 1923-24, $5; Engineering Society, $3)....$16 00

The fees below are payable as they are incurred.

Special Charges.

Pro tanto allowance of courses	$10 00
Late registration. See Regulation 1	3 00
Supplemental Examination	10 00
Writing at outside centre in April (if permitted)	5.00
Late application for supplemental examination or graduation	3 00

Fees for Single Classes.

Registration	10 00
Examination	10 00
Student Interests	16 00
Any course of lectures	12 00
Drawing, One Course, per Session	12 00

Surveying, One Course, per Session	12 00
Assaying Laboratory, per Session	5 00
Chemical Laboratory, per Session	15 00
Petrographical Laboratory, per Session	5 00
Mechanical, Electrical or General Engineering Laboratory, per Session	15 00

FEES FOR M.Sc. WORK.

Registration, Tuition and Examination	$ 60 00
Laboratory Fee and Deposit	20 00
Student Interests	16 00

GRADUATION AND OTHER FEES.

The Graduation Fee is payable before March 15. This fee is returned to unsuccessful candidates.

Extra fee for degree in absentia	$ 10 00
Graduation B.Sc.	20 00
" M.Sc.	20 00
Supplemental Examination	10 00
Admission *ad eundem statum*	10 00

12. DEPOSITS.—For covering expenses of breakages, etc., a first year student must deposit $5 with the Treasurer. If at any time the amount of breakages, etc., exceed $3, an additional deposit of $5 must be made. Students in Courses B and D make a deposit of $10 in their second, third and fourth years. For other students the deposit is $5. Charges will be made for the use of platinum, and specially expensive chemicals and apparatus. All money to the credit of the depositors will be returned at the end of the session on presentation of the deposit receipt properly certified.

13. STUDENT SELF-GOVERNMENT.—All students are members of the Alma Mater Society, the chief instrument of student government, and are expected to share in its duties and responsibilities.

DEGREES.

I. Bachelor of Science.

1. The degree of B.Sc. will be given on the satisfactory completion of a four years' course in any one of the following departments:—

A. Mining and Metallurgical Engineering.
B. Chemistry.
C. Mineralogy and Geology.
D. Chemical and Metallurgical Engineering.
E. Civil Engineering.
F. Mechanical Engineering.
G. Electrical Engineering.
H. Physics.

A graduate in any course who desires to take the degree of B.Sc. in any other course, or a student desiring to change from one course to another, shall take all the classes which he has not already passed, in that course, or, by examination satisfy the Department in charge of those classes as to his knowledge of the subjects involved.

2. The degrees of B.A. and B.Sc. will be given on the satisfactory completion of a six years' course in Arts and Science according to the description, page 40.

A candidate for graduation must have completed either a four or a six years' course and have passed all the required examinations.

II Master of Science.

The degree of Master of Science (M.Sc.) is granted to candidates who have graduated as B.Sc. and thereafter have spent at least one full session in attendance at the Faculty of Applied Science.

The work prescribed will consist of two parts as follows:—

A. Research and Thesis representing not less than half the session's work. Except by special permission the thesis must be submitted by April 30. A candidate who is allowed to postpone must submit his thesis by September 20 if he desires a degree at the fall convocation.

B. One or both of the following which shall be cognate to the thesis and be tested by examinations:

(a) Prescribed lecture courses. These, however, except by special permisson are not to be regular undergraduate courses.

(b) Directed special studies with reports.

In addition to this, examinations are required on subjects similar to that treated in the thesis. These examinations must be written in April.

Candidates must give notice of their intention to proceed to the degree of M.Sc. by October 15; they must satisfy the faculty of their fitness to proceed, and must have their programme of work approved by a committee consisting of the Dean, the Registrar and the Departments concerned.

Note.—For B.A. and M.A. courses in Chemistry, Physics, Mineralogy, Geology, etc., see Calendar of the Arts Faculty.

DOMINION LAND SURVEYORS.

The Degree in Mining or in Civil Engineering of Queen's University, Kingston, is equivalent to the "diploma as Civil Engineer" mentioned in

Clause III. of the Dominion Lands Act; so that a candidate for D.L.S. having that degree from Queen's University is entitled to examination after one year's service with a D.L.S.

ONTARIO LAND SURVEYORS.

The Ontario Land Surveyors' Act, I. Geo. V., C. 41, S. 28.—"The privilege of a shortened term of apprenticeship shall be accorded to any graduate of . . . the School of Mining, Kingston,* in Civil Engineering, or in Mining Engineering, and such person shall not be required to pass the preliminary examination hereinbefore required for admission to apprenticeship with a land surveyor, but shall only be bound to serve under articles with a practising land surveyor, duly filed as required by section 32 of this act, during twelve successive months of actual practice, after which, on complying with all the other requirements, he may undergo the examination prescribed by this Act."

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*Now the Faculty of Applied Science of Queen's University.

COURSES.

A. Mining and Metallurgical Engineering.
B. Chemistry.
C. Mineralogy and Geology.
D. Chemical and Metallurgical Engineering.
E. Civil Engineering.
F. Mechanical Engineering.
G. Electrical Engineering.
H. Physics.

A.—MINING AND METALLURGICAL ENGINEERING.

This course is necessarily a very broad one, so that it may give a foundation for whatever branch of these professions a graduate may follow. Experience has shown that graduates do not usually follow any narrow differentiation which they make during their course, but are governed by many other factors in the practice of Mining and Metallurgical Engineering. These factors are often out of their control, and the wisest plan in a four years' course appears to be, not to specialize, but by a broad training, in the final years, to obtain a suitable introduction to any branch of the work.

There are, however, some well known avenues towards professional work, such as a good training and a manipulative skill in drafting, chemical analysis, and surveying. These subjects are common, and imperative, to almost any professional position in mining and metallurgy, therefore, they are perfected as far as is possible while at college.

At the present time there are no summer classes, or summer field work in mining or metallurgy. Under these conditions the student can, usually, obtain practical and remunerative work, during four or five months each summer. This work, if in connection with Mining, Metallurgy or Surveying is considered to be more useful as a training than practical work under academic supervision.

FIRST YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
English	2	0	46
Mathematics I.	2a, 1b	2	48
Mathematics II	2a, 1b	0	48
Mathematics III	2b	0	48
Mathematics IV	2a	0	49
Astronomy I.	2b	0	50
Projection	0	2	97
Physics I. & II.	4	2	51

	Lect. Hrs. per week	Lab. Hrs. per week.	Page.
Chemistry I. ..	3	3	56
Drawing I. ..	0	5	97
Surveying I. ..	0	2	85
Physical Drill ..	0	2	98

SECOND YEAR.

Same as *Courses B, C, D.*

Mathematics V.	4a, 2b	0	49
Astronomy II.	2b	0	50
Descriptive Geometry ..	0	5a	98
Physics III. ..	3	2	52
Chemistry 15 ..	2	6	58
Mineralogy I. ..	1	2	67
Geology I. ..	2	0	63
General Engineering I.	2	0	78
Surveying III. ..	1	3	86
Drawing II.	0	5b	97

THIRD YEAR.

Chemistry 31 ..	1	3	59
Mineralogy III. ..	2a	0	68
Mineralogy IV. ..	1	2	68
Geology III. ..	1a, 2b	1a, 2b	64
Mining I. ..	1a, 2b	1a	69
Ore Dressing ..	1a, 2b	1b	72
Metallurgy II. ..	2	0	74
Thermodynamics I.	2a	0	94
General Engineering V.	1	2	80
General Engineering III.	0	3	80
Hydraulics I. ..	2	0	82
Electrical Engineering I. ..	1a, 2b	0	87
Surveying V. ..	1a	3a	86
Fire Assaying ..	1b	3b	76

FOURTH YEAR

Industrial Chemistry 73 ..	1	0	61
Mechanical Engineering IV. ..	2a, 1b	0	91
Geology V. ..	1a	0	64
Geology VIII. ..	2a, 3b	0	65
Metallurgy IV. ..	3	0	74

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Milling	0	10	72
Mining II.	3	0	70
Mining III.	0	6	71
Economics	2	0	47
Summer Essay			

B.—CHEMISTRY.

This course is designed to fit men for the profession of expert chemists, teachers of chemistry, specialists in all lines of industrial professions where chemistry serves as the basis of the industry.

The great need for men well equipped for the profession of chemist is shown in the increasing demands coming to all universities for such men. Graduates are fitted to do constructive work in research laboratories and in industrial plants.

First Year.

Same as first year *Course A.*

Second Year.

Same as *Courses A, C, D.*

Mathematics V.	4a, 2b	0	49
Astronomy II.	2b	0	50
Descriptive Geometry	0	5a	98
Physics III.	3	2	52
Chemistry 15	2	6	58
Mineralogy I.	1	2	67
Geology I.	2	0	63
General Engineering I.	2	0	78
Surveying III.	1	3	86
Drawing II.	0	5b	97

Third Year.

Chemistry 35	2	6	59
Chemistry 71	2	3	61
Chemistry 41	2	3	60
Chemistry 21	2	3	58
Physics XIV.	0	2a	55
Mineralogy IV	1	2	68
Metallurgy II.	2	0	74

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
German	3	0	46
Reports and Essays	1	0	62
FOURTH YEAR.			
Chemistry 101	2a	3a	57
Chemistry 106	0	3b	57
Chemistry 121	2	6	58
Chemistry 45	2	3	60
Chemistry 141	2b	3b	60
Chemistry 171	2a	3a	62
Economics I.	2	0	47
German	3a	0	46
Reports and Essays	0	2	62
Option in Chemistry			
Chemistry, 201, 221, 241 or 271	0	3a, 6b	

C.—MINERALOGY AND GEOLOGY.

This course is designed to meet the requirements of students who desire a theoretical and practical knowledge of the constitution and history of the Earth. It furnishes a foundation for the professions of mineralogy, geological surveying, mining and consulting geology, and is useful for those who will in any way be connected with the discovery or the development of the natural resources of the country. It forms a good preliminary course for the mining engineer who wishes to understand thoroughly the groundwork of his profession. Since a knowledge of chemistry is essential for proper comprehension of many mineralogical and geological phenomena, considerable stress is laid on this science in the earlier part of the course. The departments of mineralogy and geology are furnished with well equipped laboratories for the physical and chemical examination of minerals, rocks and ores, and also with collections of illustrative material. While field excursions are made during the session, students are advised to spend the summer vacations in practical field work.

First Year.

Same as first year *Course A.*

Second Year.

Same as *Courses A, B, D.*

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics V.	4a, 2b	0	49
Astronomy II	2b	0	50
Descriptive Geometry	0	5a	98
Physics III.	3	2	52
Chemistry 15	2	6	58
Mineralogy I.	1	2	67
Geology I.	2	0	63
General Engineering I.	2	3	78
Surveying III.	1	3	86
Drawing II.	0	5b	97

Third Year.

Chemistry 31	1	3	59
Chemistry 41	2	3	60
Mineralogy II.	2b	0	68
Mineralogy III.	2a	0	68
Mineralogy IV.	1	2	68
Mineralogy V.	0	2	69
Geology II.	3	0	63
Geology III.	1a, 2b	1a, 2b	64
Ore Dressing	1a, 2b	1b	72
Surveying V.	1a	3a	86
Reports	0	3	

Fourth Year.

Geology V.	1a	0	64
Geology VI.	1	1	64
Geology VII.	0	2	65
Geology VIII.	2a, 3b	0	65
Geology X.	0	3	66
Mineralogy VI	2	0	69
Metallurgy II.	2	0	74
Mining IV	2a, 1b	0	71
Assaying	1b	3b	76
Biology	2a	0	
Economics I.	2	0	47
German	3	0	46
Advanced Analytical and Thesis	0	9	69

D.—CHEMICAL AND METALLURGICAL ENGINEERING.

In the construction and operation of chemical works and metallurgical plants the services of men who combine a thorough knowledge of chemistry with an education in engineering are required. The course in Chemical and Metallurgical Engineering gives a training along both these lines, including a grounding in a competent knowledge of those materials of construction and the special kinds of plants and processes which are in use in the works mentioned.

The first two years of the course are the same as those in the courses in Chemistry and in Mining and Metallurgy.

Specialization begins in the third year, part of the time in this year being devoted to the study of Chemistry or of Chemistry and Metallurgy and part to Civil and Mechanical Engineering. On entering the third year, students choose those optional subjects more especially relating to Chemical Engineering or to Metallurgy.

This specialization is continued in the fourth year, which enables students to pursue advanced work in Chemical Engineering, Metallurgy, and Chemistry.

Visits are paid to local and to at least one outside chemical or metallurgical works, attendance being required.

First Year.

Same as First year, *Course A.*

Second Year.

Same as *Courses A, B, C.*

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics V	4a, 2b	0	49
Astronomy II.	2b	0	50
Descriptive Geometry	0	5a	98
Physics III.	3	2	52
Chemistry 15	2	6	58
Mineralogy I.	1	2	67
Geology I.	2	0	63
General Engineering I.	2	0	78
Surveying III.	1	3	86
Drawing II.	0	5b	97

Third Year.

Chemical Engineering.

Chemistry 31	1	3	59
Chemistry 41	2	3	60

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Chemistry 71 ..	2	3	61
Thermodynamics I. ..	2a	0	94
General Engineering V.	1	2	80
General Engineering III.	0	3	80
Electrical Engineering I. ..	1a, 2b	0	87
Mechanical Engineering I.	2a	0	90
Mechanical Engineering III.	0	3a	91
Hydraulic Engineering I. ..	2	0	82
Chemistry 21 ..	2	5b	58
Chemistry 31 ..	0	2b	59
Metallurgical Engineering.			
Chemistry 31	1	3	59
Chemistry 41	2	3	60
Chemistry 71	2	3	61
Thermodynamics I	2a	0	94
General Engineering V.	1	2	80
General Engineering III.	0	3	80
Electrical Engineering I.	1a, 2b	0	87
Mechanical Engineering I	2a	0	90
Mechanical Engineering III.	0	3a	91
Hydraulic Engineering I.	2	0	82
Metallurgy II.	2	0	74
Metallurgy III. ..	1b	0	74
Ore Dressing ..	1a, 2b	1b	72
Fire Assaying ..	1b	3b	76
Fourth Year.			
Chemical Engineering			
Chemistry 45 ..	2	3	60
Mechanical Engineering IV.	2a, 1b	0	91
Economics I. ..	2	0	47
Structural Engineering III.	1	3	81
Chemical Engineering I.	2	3	76
Chemical Engineering II.	1	6	77
Metallurgy II. ..	2	0	74
Ore Dressing ..	1a, 2b	1b	72
Metallurgy Lab. I.	0	3a	75
Shop Work	0	3b	96
Metallurgical Engineering			
Chemistry 45	2	3	60
Mechanical Engineering IV	2a, 1b	0	91
Economics I	2	0	47
Metallurgy IV. ..	3	0	74
Metallurgy VI. ..	1b	0	75
Metallurgy V.	1	0	75
Metallurgy VII.	0	2	75
Metallurgy Lab. II.	0	3	75
Milling	0	10	72
Mining IV	2a, 1b	0	71

E.—CIVIL ENGINEERING.

In this course the two main divisions of Civil Engineering, namely Surveying and Draughting, on the one hand, and Structural Design and Construction, on the other, receive full consideration. During the earlier years of the course a sound training along engineering lines is given in Mathematics, Physics, Mechanics and other allied subjects, which are essential to the proper education of an engineer. The student is also made familiar with the use of the various instruments, and by many hours of practical work in the field and draughting room, becomes skilled in the ordinary operations of Surveying. During the same period the foundation work for structural design is laid by courses of lectures in materials of construction, as well as by demonstrations and practical work in the testing laboratories. The second year is closed by two weeks of Engineering Field Work, whereby the student is brought into contact with the problems of railway location, and hydrographic surveying. During the final years more highly specialized instruction and training are given along the lines of the two main divisions, with particular regard to the economic conditions of modern construction. At frequent intervals excursions are undertaken to the quarries, cement works, brick kilns, bridges, railway structures, canals and graving docks, which are to be found within easy distance of Kingston.

First Year.

Same as First year *Course A.*

Second Year.

Same as *Courses F, G.*

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics V	4a, 2b	0	49
Astronomy II.	2b	0	50
Descriptive Geometry	0	5a	98
Physics III.	3	2	52
Physics IV.	0	2b	52
Chemistry 13	1	2	57
General Engineering I.	2	0	78
Mechanical Eng. IX.	1	2	93
Surveying II.	1	3	85
Drawing III	0	5b	97
Shop Work	0	3	96

Third Year.

Metallurgy I.	1	0	74
Thermodynamics I.	2a	0	94

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
General Engineering II. . .	2	0	79
General Engineering III. .	0	3	80
General Engineering VI.	1	3	80
Structural Engineering I.	1	5	81
Hydraulic Engineering I. . .	2	0	82
Surveying IV. . .	1	3	86
Municipal Engineering I. ..	2b	0	84
Railway Engineering I.	2a, 1b	3	83
Electrical Engineering I. ..	1a, 2b	0	87
FOURTH YEAR.			
Industrial Chemistry 73 ..	1	0	61
General Engineering IV. . .	0	2	80
Railway Engineering II	1	2	83
Railway Engineering III.	1	2	83
Municipal Engineering II.	1	2	84
Municipal Engineering III. ..	1	1	84
Highway Engineering I.	1	0	85
Mechanical Engineering IV.	2a, 1b	0	91
Hydraulic Engineering II.	2	0	82
Structural Engineering II.	1	3	81
Structural Engineering IV.	1	5	81
Economics I.	2	0	47
Engineering Economics . .	1	0	83

F.—MECHANICAL ENGINEERING.

The profession of Mechanical Engineering embraces the design, manufacture and operation of all classes of machinery, of power plants and manufacturing plants, as well as the executive management of industries. A four years' course therefore must be broad enough to give the student a thorough training in the fundamental principles, and any sub-divisions intended to train a student for any one of the many specialties only, seem unwise, and are impracticable on account of the lack of time.

The first two years are devoted to the study of the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including experimental work in the various laboratories. Special attention is given to the subject of strength of materials, with practice in testing during the second and third years. The study of the steam engine and other forms of heat-engines, includes courses in Thermodynamics, Valve Gears, Governors and the Balancing of Engines. Instruction is given in Mechanism, Machine

Design, Shop Work, and the fundamental principles of Electrical Engineering. Instruction in drawing extends over the four years, and gives a thorough drill in modern drafting room practice. In the more advanced courses of the fourth year the student is taught how to apply the general principles to the design and operation of special machinery, steam and gas engines, steam boilers and gas producers, and complete power plants; *i.e.*, each student is allowed to specialize as far as is practicable. The instruction in the laboratories is intended not only to familiarize the student with standard methods of testing, but also to teach him how to attack original problems.

The fourth year students are kept in touch with the local manufacturing concerns in order to familiarize them with modern power plant and shop practice.

First Year.

Same as First year *Course A.*

Second Year.

Same as *Courses E, G.*

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Mathematics V	4a, 2b	0	49
Astronomy II	2b	0	50
Descriptive Geometry	0	5a	98
Physics III.	3	2	52
Physics IV.	0	2b	52
Chemistry 13	1	2	57
General Engineering I.	2	0	78
Mechanical Engineering IX.	1	2	93
Surveying II.	1	3	85
Drawing III.	0	5b	97
Shop Work	0	3	96

Third Year.

Mathematics VI.	2a	0	49
Thermodynamics I.	2a	0	94
Thermodynamics II.	1b	0	94
Thermodynamics V.	1	2	95
General Engineering V.	1	2	80
General Engineering III.	0	3	80
Electrical Engineering I.	1a, 2b	0	87
Metallurgy I.	1	0	74
Mechanical Engineering I.	2	0	90

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mechanical Engineering II.	2b	0	91
Mechanical Engineering III.	0	6	91
Shop Work	0	3	96
Hydraulic Engineering I.	2	0	82
Mechanical Engineering IV.	2a, 1b	0	91
Fourth Year.			
Industrial Chemistry 73	1	0	61
Thermodynamics III.	2	3a	94
Thermodynamics IV.	0	6	95
Electrical Engineering VII	1	2	88
Mechanical Engineering V.	4	6	92
Mechanical Engineering VI.	2a, 1b	0	92
Mechanical Engineering VIII.	0	3b	93
Mechanical Engineering X.	2a	0	93
Mechanical Engineering XI.	2b	0	94
Economics I.	2	0	47

G.—ELECTRICAL ENGINEERING.

The instruction in the first two years of the course in Electrical Engineering provides for a thorough training in the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including suitable work in the various laboratories. Part of the time is devoted to elementary drawing and shop work. In the third year the work consists of an introduction to the general principles underlying all electrical work together with elementary laboratory work. Considerable time is devoted to the study of Thermodynamics and advanced mechanical drawing. The fourth year is devoted to the study of the theory and action of the main types of electrical apparatus, the design and operation of central stations, electric lighting, electric railways and power transmission.

An important part of the work consists in the working out of problems such as are frequently met with in practical work. In this way the student is trained in the application of theory to the solution of practical problems.

Arrangements are made for occasional visits to electrical works.

The whole course is designed to give the student a thorough understanding of the general principles which constitute the basis of all electrical work, together with a knowledge of how these principles are applied in practice. No effort is made to give that intimate knowledge of practical details which experience alone can supply.

FIRST YEAR.

Same as First year *Course A.*

SECOND YEAR.

Same as *Courses E and F.*

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics V.	4a, 2b	0	49
Astronomy II	2b	0	50
Descriptive Geometry	0	5a	98
Physics III.	3	2	52
Physics IV.	0	2b	52
Chemistry 13	1	2	57
General Engineering I.	2	0	78
Mechanical Engineering IX.	1	2	93
Surveying II.	1	3	85
Drawing III.	1	3	97
Shop Work	0	5b	96
THIRD YEAR.			
Mathematics VI.	2a	0	49
Mathematics VII.	2b	0	49
Physics V.	2a	3	53
Thermodynamics I.	2a	0	94
Thermodynamics II.	1b	0	94
General Engineering V.	1	2	80
General Engineering III.	0	3	80
Electrical Engineering II.	2	2	87
Electrical Engineering III.	2a, 3b	3	88
Mechanical Engineering I.	2	0	90
Mechanical Engineering II.	2b	0	91
Mechanical Engineering VII.	0	3	93
Metallurgy I.	1	0	74
Hydraulic Engineering I.	2	0	82
FOURTH YEAR.			
Physics XV	2a	3b	55
Hydraulic Engineering II	2	0	82
Hydraulic Engineering III	3a	0	82
Metallurgy VI.	1b	0	75
Thermodynamics III.	2	3a	74
Electrical Engineering V.	4	6	88
Electrical Engineering VIII.	1	3	88
Mechanical Engineering X.	2a	0	93
Economics I.	2	0	47
One of the following classes:—			
Electrical Engineering IX.	1	3	88
Electrical Engineering X.	1	3	89
Electrical Engineering XI.	1	3	89

H.—PHYSICS.

This course is designed to fit men for positions as physicists in research laboratories.

The importance of a thorough grounding in the fundamental subjects of Physics, Mathematics, and Chemistry, cannot be over-emphasized, so these subjects form the major part of the course. The engineer's point of view is secured from the classes of the Faculty of Applied Science, while the breadth of view, necessary for a research worker, is gained from the advanced theoretical classes in the major subjects of the course. Students contemplating taking this course are urged to acquire a reading knowledge of French and German as early in the course as possible.

First Year.

Same as First year *Course A.*

Second Year.

The Second year of any Course.

Third Year.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics VIII. ..	3a	0	49
Mathematics IX. ..	3b	0	49
Physics V. ..	2a	3	53
Physics VI. ..	2b	0	53
Physics VII. ..	2a	3	53
Physics VIII. ..	2b	0	54
Chemistry 31 ..	1	3	59
Electrical Engineering II.	2	2	87
German	3	0	46

Fourth Year.

Mathematics X. ..	3a	0	50
Mathematics XI. ..	3b	0	50
Physics IX. ..	2a	0	54
Physics X. ..	2b	0	54
Physics XI. ..	2b	0	54
Physics XII. ..	2b	0	54
Physics XIII. ..	0	9	55
Physics XV	2a	3b	55
Electrical Engineering VIII	1	3	88
German or French	3	0	46-47
Economics I. ..	2	0	47

GRADUATE YEAR IN COMMERCE.

The demand for engineers with business training has led to the establishment of a year's work in Commerce for graduates in Engineering of Queen's and other Universities.

The purpose of this course is to aid in preparing men who already have the technical equipment for work in the administrative or financial branches of industry.

A certificate will be awarded to students successfully completing the course.

The subjects offered are as follows:—

Economics	25a.	Money and Banking
„	50a.	Industrial Management
„	52a.	Marketing
„	54a.	Business Finance
„	60a.	Commercial Law
„	62a.	Accounting
„	21b.	Transportation
„	56b.	Statistics
„	58b.	Office Management
„	59b.	Business Policy
„	68b.	Accounting and Costs

Details of this work may be found in the Calendar of the Faculty of Arts. Each class meets three times a week, the letter *a* indicating the first term and the letter *b* the second term.

A report on some Canadian Industry will be assigned each student. Students who have not already taken an elementary course in Economics will be required to take such a course in place of part of the above work.

COURSE FOR B.A. LEADING TO THE DEGREES OF B.A. AND B.Sc. IN SIX YEARS.

Students taking these courses are required to have Arts Matriculation and to register the first two years in Arts alone and pay the class and registration fees in Arts, to register the second two years in both Arts and Science, to pay both registration fees, with examination fees as required, and the Science class fees and to register the last two years in Science only, paying the registration and class fees. Arts classes are subject to the regulations in the Arts Calendar, and Science classes to the regulation in the Science Calendar.

The courses for B.A. and B.Sc. must be taken as laid down in the following scheme. The regulations regarding back classes on page 23 will be applied on these courses.

First Year.

1. English 1.
2. French 1 or German 1.
3. Mathematics 1.
4. Mathematics IV. (Science).
5. Astronomy I. (Science).
6. Physics 1.
7. Chemistry 1.

Second Year.

English 2.
French 2 or German 2; or Latin, Greek, or Spanish.
Course from Group II.
Course from Group II.
Course in a subject previously taken but not covered by the later courses in Science.

Third Year.

1. Course from Group I.
2. Course in a subject previously taken but not covered by the later courses in science.
3. Mathematics I., II., and III.
4. Surveying I.
5. Drawing I.
6. Projections I.

Students are reminded that the regulations for distribution of work (Arts Calendar) require that Philosophy 1 or 2 be included among the courses taken from Group II.

Fourth, Fifth, and Sixth Years.

The fourth, fifth, and sixth years are the same as the second, third, and fourth years of the B.Sc. Courses.

If a student on one of these courses wishes to specialize in one or more of the Arts subjects, he may do so in the honour classes.

Attention is called to the fact that by proper selection of classes an entire Arts course leading to the degree M.A. and a B.Sc. course in the Faculty of Applied Science, can be completed in seven years.

SUBJECTS OF STUDY

ENGLISH LANGUAGE AND LITERATURE.

PROFESSOR—J. F. Macdonald, M.A.

FIRST YEAR ENGLISH.

Reading, practical composition and debating.

Texts:—*The New World* (Macmillan Company).
Shakespeare's *Hamlet.*

Tuesday and Thursday, 10 a.m.

GERMAN.

PROFESSOR—John Macgillivray, B.A., Ph.D.
ASSISTANT PROFESSOR—

GERMAN A.—PREPARATORY COURSE.

This course is intended to meet the needs of students who enter the University with little or no knowledge of German. It is taken by students who need to complete their Matriculation, or who desire to pursue a course in which German text-books or works of reference are prescribed or recommended. The requirements correspond generally to those for Junior Matriculation. The course will count towards a degree.

The work comprises drill on pronunciation, a study of the elements of grammar, the reading of easy literature, dictation, oral and written composition.

Text-books: Schrag and Alexis, *First Course in German.*
Volkmann-Leander, *Träumereien Selections* (Ginn).
Collmann, *Easy German Poetry Selections* (Ginn).

Lectures—Tuesdays, Thursday, Saturday, at 2 or a time to be selected.

GERMAN 3A.—SCIENTIFIC GERMAN.

This course is designed for students, who are doing advanced work in chemistry, physics, geology, mineralogy, biology and anatomy. The reading will be selected to suit members of the class. Prerequisite: German A, or Matriculation in German.

Text-books: One of:
Helmholtz, *Populäre Vorträge* (Heath).
Du Bois-Reymond, *Wissenschaftliche Vorträge* (Ginn).

Lectures—Monday, Wednesday, Friday at 9, or a time to be arranged.

FRENCH.

Lecturer—Mme. McConnell, B.S., C.A.P.

French A.

The class meets on Monday, Wednesday and Friday at 2 p.m. and the work, which leads up to *Junior Matriculation*, includes study of Grammar (Fraser and Squair) *High School French Grammar* (Heath) and one of the text-books of the French Class, together with elements of pronounciation, reading and dictation.

French I

See prescription in the Arts Calendar.

SPANISH.

Professor—J. H. Brovedani, Docteur ès Lettres.

VOLUNTARY CLASSES.

ELEMENTARY SPANISH.

This Class meets on Monday and Friday at 9 a.m.

ADVANCED SPANISH.

This Class meets on Monday and Friday at 9 a.m.

N.B.—Students who choose Spanish as a subject for the combined course leading to the degree of B.A. and B.Sc. must take it as prescribed in the Calendar of the Faculty of Arts.

ECONOMICS.

Assistant Professor of Commerce.—C. E. Walker, B.Sc. Acc., C.A.

Economics I.—Fourth Year.

A study of the economic and business problems of the engineer with regard to the organization, financing and management of engineering enterprises and the preparation of accounting and cost records. The course will also include a discussion of law as applied to the business problems dealt with.

Lectures—Monday, Wednesday, at 9. Professor Walker.

MATHEMATICS.

PROFESSOR—J. Matheson, M.A.

PROFESSOR—C. F. Gummer, M.A.

ASSOCIATE PROFESSOR—N. Miller, M.A., Ph.D.

ASSISTANT PROFESSOR—K. P. Johnston, B.A., B.Sc.

1. Mathematics I., II., III., IV. and Astronomy I. are required of all first year students. In addition to the six hours a week allotted to these courses, two hours a week will be spent in working problems under the supervision of members of the Department. These hours are Monday, 10-11, and Thursday, 3-4.

2. Mathematics V, and Astronomy II. are required in the second year in all courses.

3. Mathematics VI. is required in the third year in courses F and G; and Mathematics VII. in the third year in Course G.

4. Mathematics VIII., IX. are required in the third year in Course H, and Mathematics X., XI. in the fourth year in Course H.

MATHEMATICS I

TRIGONOMETRY, to cover spherical trigonometry and a review of the more important parts of plane trigonometry.

Tuesday and Thursday, 9-10, 1st term, and *Tuesday,* 9-10, 2nd term.
Professor Gummer and Professor Johnston.

MATHEMATICS II.

ALGEBRA, to cover undetermined coefficients, convergence of series, summation of series, continued fractions, logarithms, exponentials, and annuities, with a review of the more important parts of Algebra as far as the binomial theorem.

Tuesday and Thursday, 11-12, first term, and *Thursday,* 9-10, 2nd term.
Professor Gummer and Professor Miller.

MATHEMATICS III

ANALYTIC GEOMETRY, reviewing the geometry of the straight line and circle, and covering the properties of curves which are of importance in engineering practice. Introduction to the co-ordinate Geometry of three dimensions.

Tuesday and Thursday, 11-12, second term.
Professor Gummer and Professor Miller.

MATHEMATICS IV

SYNTHETIC SOLID GEOMETRY, covering the properties of the principal solid figures, methods and formulae for areas and volumes, etc.

Wednesday and Friday, 10-11, first term.
Professor Matheson and Professor Johnston,

MATHEMATICS V

DIFFERENTIAL AND INTEGRAL CALCULUS, with application to curves and curve tracing; measurement of lengths, areas, volumes; pressure, mass centre, moment of inertia; mechanical quadrature; elementary differential equations and applications.

Monday, Wednesday and Friday, 11-12; *Tuesday,* 10-11, first term.
Monday and Wednesday, 11-12, second term. Professor Miller.

MATHEMATICS VI

A continuation of Mathematics V. to cover more fully such topics as partial differentation, expansions, double and triple integration, and differential equations; and a continuation of Mathematics III. in Analytic Solid Geometry.

Monday and Friday, 11-12, first term, Courses F. G.
Professor Gummer.

MATHEMATICS VII.

A continuation of Mathematics VI. to include the study of hyperbolic functions, the use of the complex variable, and a more detailed study of selected topics.

Wednesday and Friday, 10-11, Course G, second term.
Professor Gummer.

MATHEMATICS VIII.

A course in Higher Algebra to cover such topics as convergence of series and determinants, and to extend the study of subjects begun in Mathematics II.

Monday, Wednesday and Friday, 11-12, first term, Course H.

MATHEMATICS IX.

A course in Calculus to follow Mathematics V. This course will emphasize the theoretical side of the subject, and prepare for advanced study.

Monday, Wednesday and Friday, 11-12, second term, Course H.

MATHEMATICS X.

A course in Analytic Solid Geometry involving a study of various solid figures and of the general properties of surfaces. Introduction to Differential Geometry.

Tuesday, Thursday and Saturday, 8-9, first term.

MATHEMATICS XI.

A course in differential equations to include the more important methods of solution for ordinary and partial differential equations.

Tuesday, Thursday and Saturday, 8-9, second term, Course H.

ASTRONOMY I

ASTRONOMY, including the fundamental principles of the subject, such as the systems of co-ordinates, the shape and motions of the earth, the motions of the moon, planetary motion, time.

Wednesday and Friday, 10-11, second term.

Professor Matheson and Professor Johnston.

ASTRONOMY II

Applications of Spherical Trigonometry to Geodesy and Astronomy. The methods of least squares.

Tuesday, 10-11, *and Friday*, 11-12, second term.

Professor Johnston.

PHYSICS.

Professor—A. L. Clark, B.Sc., Ph.D., F.R.S.C.

Research Professor—A. Ll. Hughes, B.A., D.Sc., F.R.S.C.

Professor—W. C. Baker, M.A.

Associate Professor—J. K. Robertson, M.A.

Assistant Professor—E. Flammer, B.Sc., Ph.D.

Lecturer—W. V. Ball, B.A., Sc.

Assistant—G. W. Hudson, B.Sc.

The work in Physics is carried on in lecture and laboratory courses, which run parallel to each other. In the lecture room the fundamental principles are developed and applied, experimental demonstrations given and many problems solved. In all classes in Physics weekly exercises are required of students. In the laboratory a large number of experiments are performed. These are designed to train the student in manipulation of apparatus and instruments of precision, to teach him to make accurate measurements and to give practice in properly recording, interpreting and reducing experimental data.

In all the courses in Physics, the work in the laboratories will be counted as a certain percentage of the whole work of the session. In estimating the standing in the laboratory work, both the quantity and quality of the work done will be considered.

Physics I. and II., together forming a complete introductory course, are taken by all first year students. Previous knowledge, though valuable, is not required. The laboratory work of this year is arranged to supplement the lectures in both Physics I. and II., and credit for this work is given on the written papers in both subjects. Students in both classes have opportunity for assistance by Douglas Tutors. (See page 24).

PHYSICS I.

The subjects dealt with include the elementary treatment of uniformly accelerated motion, Newton's Laws and their application as the basis of Mechanics, Vector addition applied to simple cases of forces, velocities, momenta, etc., Work, Power, Moments, Simple cases of Centre of Mass and of Equilibrium, the application of mechanical ideas to the elementary statics of liquids and gases.

Monday and Friday at 11 a.m. Professor W. C. Baker.

PHYSICS II.

A course of lectures of two hours per week on Magnetism, Electricity, Wave Motion, Sound, Light and Heat. These topics are discussed mathematically and illustrated by experiments.

Lecture—Wednesday, at 11 a.m.
Saturday, at 9 a.m.

Laboratory—Sec. I.,*Monday,* 1-3 p.m.
Sec. II., *Wednesday,* 1-3, p.m. Professor Flammer and Mr. Ball.

PHYSICS III.

This class is required of all students.

This course of lectures is a continuation of Physics I. Mathematics V is taken at the same time as this class, consequently during the latter part of the year the Calculus is used freely. A general review of the important fundamental principles of Physics occupies the first few weeks. These are then applied to problems dealing with Motion in a Circle, Simple Harmonic Motion, Composition of Simple Harmonic Motions with applications, Moments of Inertia, Rotation, Friction of Belts, Pivots and Bearings, Elasticity in Stretching, Bending and Twisting, Energy and its Transformations. In the part of the work devoted to electricity there is a detailed discussion of the following topics:—Ohm's Law, Shunts, Available Voltage, Electrical Energy, Power, Kirchhoff's Laws, Laws of Electrolysis, Electromotive forces of cells, the Magnetic circuit and Electromagnetic Induction, etc. Throughout the year, weekly exercises are required of the students.

The laboratory work, which runs parallel with the lectures, is a continuation of the work of the first year.

Lectures—Monday, Wednesday and Friday, 9-10.
Professors Clark and Robertson

Laboratory—Courses A, B, C, D,—Sec. I.—*Monday,* 1-3.
" E. F. G. Sec. II—*Friday,* 1-3.
Mr. Hudson.

PHYSICS IV.

This class is required of second year students in Courses E, F, and G.

The work of this class consists of a course of experiments in electrical measurements, involving measurement of resistance by Wheatstone's Bridge, determination of various electrical and magnetic constants, a study of such electrical instruments as galvanometers, ammeters, voltmeters and the simple potentiometer.

Laboratory—Tuesday, 3-5, second term.
Professor Flammer and Mr. Hudson.

PHYSICS V.

Required of third year students in Courses G and H.

The work of this class comprises a course of lectures on the Elementary Mathematical Theory of Electricity and Magnetism, and a course of laboratory experiments in advanced electrical measurement.

In the lectures are treated such topics as the more important laws and theories in Electrostatics, the laws of the Magnetic Field, Electrodynamics and Electro-magnetic Induction. At each lecture problems are assigned for solution and these are later discussed in class.

In the laboratory the students make detailed study of several groups of experiments. These comprise careful study of galvanometers using both steady and transient currents, measurements of capacities, permeability, insulation resistance, and self and mutual induction, the use of the potentiometer in measurement of electro-motive force of cells, calibration of voltmeters and ammeters, and study of electrical waves and discharge phenomena.

Lecture—Wednesday and Friday, 10-11, first term. Professor Baker.
Laboratory—Wednesday, 1-4. Professor Flammer.

PHYSICS VI.

Elementary Theoretical Mechanics.

Required of students in third year of Course H.

This course consists of a series of lectures in which the elements of Statics and Dynamics of a Particle are discussed.

Tuesday and Thursday, 10-11, first term.

Laboratory—Tuesday, 2-5, first term.

Professor Flammer,

PHYSICS VII.

Thermodynamics.

Required of students in third year of Course H.

A course in which the fundamental laws of Thermodynamics, and their application to the Thermodynamical scale of Temperature, to the treatment of Saturated Vapours, and to Reversible Processes in General, are discussed.

Tuesday and Thursday, 10-11, second term.
Laboratory—Tuesday, 2-5, second term. Professor Clark.

PHYSICS VIII.

Light and Electricity.

Required of students in third year of Course H.

The general aim of this course is to acquaint the student with the modern developments in such branches of Physics as Radiation, X-rays, Conduction of Electricity through Gases, Radioactivity, etc.

Wednesday and Friday, 10-11, second term. Professor Hughes.

PHYSICS IX

Mechanics of Rigid and Elastic Bodies.

Required of students in fourth year of Course H.

This course includes a discussion of such topics as the Motion of a Rigid Body, Ellipsoids of Inertia, Motion with fixed Axis and Fixed Point. Euler's Equations, and applications to motion of the symmetrical top; Stress and Strain relations in Elastic Bodies, Elastic Constants.

Monday and Wednesday, 11-12, first term. Professor Flammer.

PHYSICS X.

Physical Optics.

Required of students in fourth year of Course H.

A course of lectures on the theory and phenomena of Physical Optics, including a discussion of Wave Motion, Diffraction, Interference, Spectroscopes, Polarization and Double Refraction.

Tuesday and Thursday, 11-12, second term. Professor Robertson.

PHYSICS XI.

Electricity.

Required of students in fourth year of Course H.

An advanced course on Electrodynamics and the Conduction of Electricity through Gases.

Monday and Wednesday, 11-12, second term. Professor Flammer.

PHYSICS XII.

Kinetic Theory of Gases.

Required of fourth year students in Course H.

This course includes the topics of the Maxwellian distribution of velocities, free path phenomena, viscosity, thermal conductivity, diffusion, Van der Waal's equation, and the quantum theory as applied to specific heats and to radiation.

Tuesday and Thursday, 11-12, first term. Professor Hughes.

PHYSICS XIII.

Required of fourth year students in Course H.

An advanced laboratory course of experiments in Optics, Electricity and Magnetism and Heat.

Monday, Wednesday, Friday, 1-4. Professors Hughes and Robertson.

PHYSICS XIV.

Precision Measurements.

Required of third year students in Course B.

A course of laboratory experiments with occasional lectures on precision experiments, involving use of balance, spectroscope and other precision apparatus and accurate measurement of the fundamental quantities of elementary physics.

Friday, 9-11, first term. Professor Flammer.

PHYSICS XV.

Thermionics. Electron Tubes.

Required of students in fourth year of Courses G and H.

A course on the fundamental principles of Thermionics, with special reference to Electron Tubes. Typical applications of the Electron Tubes to wireless transmission, long distance telephony, etc., will be considered.

Lectures—Saturday, 9-12, first term. Professor Hughes.

Laboratory—A course of experiments on Electron Tubes designed to familiarize the student with their charactersitics and uses.

PHYSICAL LABORATORIES.

The Physics Department is located in the southern half of Ontario Hall, and contains a large lecture room, with a seating capacity of 125, a small lecture room with seating capacity of 60, a small class room, two large rooms equipped as general elementary laboratories, and one room equipped as an electrical laboratory for advanced work. Besides these rooms are the offices for the staff research rooms a large, well-lighted library and reading room, smaller rooms for special purposes, apparatus and store rooms. The equipment for lecture table and laboratory is steadily growing and comprises most of the more important pieces of apparatus for these purposes.

Research in Physics is being carried on by members of the staff and by senior students. It is desired to extend this activity as far as possible. A limited number of workers who desire to use the facilities of the laboratory may be admitted and assisted. Particulars may be obtained from the Professor of Physics.

LIBRARY.

The library contains text-books, works of reference, and journals devoted to Physics and related subjects. These may be freely consulted by the student in the reading room between the hours of 8 a.m. and 5 p.m. Books may in general be taken from the building overnight upon reporting to a member of the staff and making a record in a book provided for that purpose. It is only by special permission, however, that any book may be kept longer than one night at a time.

CHEMISTRY.

PROFESSOR OF CHEMISTRY—Arthur C. Neish, A.M., Ph.D.

PROFESSOR—L. F. Goodwin, A.C.G.I., Ph.D., F.I.C,

PROFESSOR—A. P. Lothrop, A.M., Ph.D.

ASSOCIATE PROFESSOR—J. A. McRae, M.A., Ph.D., F.I.C.

LECTURERS—A. F. G. Cadenhead, B.A.
Roy L. Dorrance, M.A.

DEMONSTRATOR—Alan Hamilton, B.Sc.

INORGANIC CHEMISTRY.

CHEMISTRY I.—General Inorganic Chemistry.

For all first year students in Science.

This course presupposes a mastery of the contents of matriculation chemistry.

In addition to studying in detail the history, methods of preparation, properties and industrial applications of the most important non-metals and metals and their compounds, the fundamental theories, laws and principles are emphasized. Simple unknowns are also given.

Texts—Alex. Smith, *General Chemistry for Colleges.*
Laboratory Outlines for College Chemistry.

Lectures—Monday, Wednesday, Friday at 9, in room 310, Gordon Hall.

Laboratory—Tuesday, 1-4, in 305, 308, Gordon Hall. Professor Neish and assistants.

CHEMISTRY 101—Advanced Inorganic Chemistry.

For students in Course B, fourth year.

In the lectures such topics are discussed as radioactivity, atomic weights, inert gases, rare metals, peracids and salts, double salts, alloys, metallic ammino compounds. In the laboratory inorganic preparations will be made such as cobalticyanides, sodiummbismuthate, cobaltamines, and a number of others as given in Biltz.

Texts—References to books in Library.

Lectures—Tuesday and Thursday, at 10, in room 105, Gordon Hall.

Laboratory—Friday, 1-4, first term, in 207, Gordon Hall.

CHEMISTRY 106—Colloid Chemistry.

For students in Course B, fourth year.

An introductory course of three hours per week for the second term. The lectures will deal with the general properties of colloids, surface phenomena, adsorption, and special stress will be laid upon the practical applications of Colloid Chemistry. The importance of the subject in the fields of both inorganic and organic chemistry will be demonstrated by laboratory experiments. These experiments will consist of the preparation of typical colloids, the various methods of identification, electrical properties "gold number." swelling and hydration of gelatins, etc.

Text.—Hatschek—Intro. to Physics and Chemistry of Colloids, new edition.

Reference Texts: Alexander—Colloid Chemistry.
Bancroft—Applied Colloid Chemistry.
Bechold—Colloids in Biology and Medicine.

Lecture and Laboratory—Friday, 1-4, *second term*; Rooms 105-101 Gordon Hall.

Mr. Cadenhead.

CHEMISTRY 201—Inorganic Chemistry (Research Training).

For graduate students and students in Course B, fourth year, electing thesis option in Inorganic Chemistry. Professor Neish, and Mr. Cadenhead.

QUALITATIVE ANALYSIS.

CHEMISTRY 13.—Qualitative and Quantitative Analysis.

For students in Courses E, F, G, second year.

A *short course* of one lecture and two hours laboratory for a year. The qualitative analysis treats of the commoner elements with unknowns suitable for Civil, Electrical and Mechanical Engineering students. The quantitative work is brief and functions as an interpretation course.

Lecture—Wednesday at 10, in room 310, Gordon Hall.

Laboratory—Section 3, *Monday*, 1-3, in 101 Gordon Hall.
Section 4, *Friday*, 1-3, in 101 Gordon Hall. Mr. Cahenhead.

CHEMISTRY 15.—Qualitative Analysis, full course.

For students in Courses A, B, C, D, and H, second year.

The lectures deal with the Theory of Analytical Chemistry, and emphasize the development and application of the laws of equilibrium as applied to solutions and reversible reactions. The laboratory work includes the systematic analysis of the usual base and acid radicals.

Texts, Stieglitz, *Qualitative Analysis Vol. I.*

A. A. Noyes, *Qualitative Chemical Analysis* 1922 *Edition.*

Lectures—Tuesday and Thursday at 11, in room 310, Gordon Hall.

Laboratory—Wednesday and Thursday, 1-4, 107-109, Gordon Hall, Mr. Cadenhead.

ORGANIC CHEMISTRY.

CHEMISTRY 21—Organic Chemistry.

For students in Courses B and Dc., third year.

An elementary course in general organic chemistry. The properties of the more important compounds are studied in the laboratory and a number of them prepared.

Texts—Perkin and Kipping, *Organic Chemistry.*

Lectures—B students, *Wednesday and Friday*, at 11 in room 105, Gordon Hall.
Dc. students, *Monday and Wednesday* at 11, in room 105.
Professor McRae.

Laboratory—B students, *Saturday*, 9-12 in 213 Gordon Hall.
Dc. students, *Wednesday*, 10-11, 1-5, second term only.
Professor McRae.

CHEMISTRY 121—Advanced Organic Chemistry.

For students in Course B, fourth year.

Advanced systematic organic chemistry including lectures on special topics, alkaloids, stereoisomerism and carbohydrates. The laboratory work

consists of the preparation of a number of substances to illustrate the general laboratory methods of Organic Chemistry. Practice in quantitative organic analysis is also given.

Texts—Bernthsen—Sudborough, *Organic Chemistry.*
Cohen, *Practical Organic Chemistry.*

Books of Reference—Cohen, *Advanced Organic Chemistry.*
Sidgwick, *Organic Chemistry of Nitrogen.*

Lectures—Tuesday and Thursday, at 11, in room 105, Gordon Hall.

Laboratory—Wednesday, 1-4 and *Saturday,* 9-12, in 213, Gordon Hall. Professor McRae.

Chemistry 221—Organic Chemistry (Research Training.)

For graduate students and students in Course B, fourth year, electing thesis option in Organic Chemistry. Professor McRae.

Quantitative Analysis.

Chemistry 31—Quantitative Analysis—Introductory Course.

For students in Courses A. C. and D, third year and Course H, fourth year.

In addition to the use and care of an analytical balance the analysis of barium chloride, alkalimetry and acidimetry, calcium carbonate, magnesium sulphate, coal, bleaching powder, iron ore, copper ore, nickel ore, lead ore, are done in the laboratory.

Texts—Waddell, *Quantitative Analysis in Practice.*

Lectures—Thursday, 1-2, in room 105, Gordon Hall.

Laboratory—Thursday, 2-5, for A. C. D and H.
Friday, 8-10, second term for Dc.

Chemistry 35—Quantitative Analysis.

For students in Course B, third year.

This course embodies Chemistry 31 but includes more advanced work such as comparison of various analytical methods, analysis of ores and alloys which give difficulties, and special problems that may arise.

Texts—References to books in the Library.

Lecture—Monday and Wednesday, at 9, in room 105, Gordon Hall.

Laboratory—Thursday, 2-5, and *Friday,* 1-4, in 207, 209, Gordon Hall.

Chemistry 231—Quantitative Analysis (Research Training).

For graduate students and students in Course B, fourth year, electing thesis option in Quantitative Analysis.

Physical Chemistry.

Chemistry 41—Physical Chemistry.

For students in Courses B, C, D, third year.

The principles of Physical Chemistry, and their application to the study of chemical reactions and equilibria. Special attention is given to problems of industrial importance. The laboratory work is designed to acquaint the student with most important physical chemical measurements and to train him in habits of accuracy, despatch, and in the planning of methods for research.

Texts—Walker, *Physical Chemistry.*
Lincoln, *Physical Chemistry.*
Findlay, *Practical Physical Chemistry.*

Lectures—Tuesday and Thursday, at 9, in room 105, Gordon Hall.

Laboratory—Tuesday, 1-4, in 115, 116, Gordon Hall.

Professor Goodwin.

Chemistry 45—Physical Chemistry, Electrochemistry.

For students in Courses B and D. fourth year.

The work of this course deals with the conduction of the electric current through solutions, considering such quantities as transport numbers, mobility of ions, specific and equivalent conductivity; the electromotive force of concentration cells, with and without diffusion, developed according to the Nernst Theory; dry cells and storage batteries; some industrial applications. The laboratory work consists in determination of the quantities discussed in the lectures and the production of some compounds such as ammonium-persulphate and white lead, electrolytically.

Texts—Allmand, *Applied Electro-Chemistry.*
Walker, *Elements of Physical Chemistry.*
Findlay, *Practical Physical Chemistry.*
Elbs-Hutton, *Electrolytic Preparations.*

Lectures—Monday, at 10, in room 105, and *Saturday* at 8, in room 310, Gordon Hall.

Laboratory—Thursday, 1-4, in 101 Gordon Hall, Mr. Dorrance.

Chemistry 141—Advanced Physical Chemistry.

For students in Course B, fourth year, second term.

This course deals with kinetics, mono-di-tri-molecular reactions and equilibria, catalysis, equations of state and kinetic theory, optimum temperatures, and thermo dynamics. Modern theory of solutions, hydration,

boiling and freezing point laws, thermo chemistry, thermo dynamics of technical gas reactions. Radio-activity and electronic theories. Radio-active transformations.

Texts—Lincoln, *Physical Chemistry.*
Washburn, *Physical Chemistry.*
Findlay, *Osmotic Pressure.*

Lectures—Monday and Friday, at 11, in 105 Gordon Hall.

Laboratory—Monday, 1-4, in 116, Gordon Hall.

CHEMISTRY 241—Physical Chemistry (Research Training).

For graduate students and students in Course B, fourth year, electing thesis option in Physical Chemistry. Professor Goodwin and Mr. Dorrance.

Laboratory—B Tuesday, 1-4, in 115, 116 Gordon Hall.

INDUSTRIAL CHEMISTRY.

CHEMISTRY 71—Industrial Chemistry

For students in courses B and D, third year.

In the lectures the following topics, illustrated by specimens, lantern slides and motion pictures and visits to plants, will be discussed: Industrial applications of air and water, natural gases, petroleum products, producer gas, water gas, coal gas, by-product coke, sulphur, sulphuric acid (chamber and contact), sulphites, hydrochloric acid, nitric acid and ammonia, nitrates (natural and synthetic), fertilizers, alkalies, mortars, and cements. In the laboratory typical industrial processes as crystallization, precipitation, filtration, distillation and rectifications, incomplete reactions, gas analysis, industrial flow sheets will be carried out and interpreted.

Texts—Rogers, *Manual of Industrial Chemistry,* or Thorpe, *Outlines of Industrial Chemistry.*

Lectures—Tuesday and Thursday at 10, room 310, Gordon Hall.

Laboratory—B, *Monday,* 1-4, in 101, Gordon Hall.
Dc., *Saturday,* 9-12, in 112, Gordon Hall.
Dm., *Saturday,* 9-12, first term, and *Wednesday,* 1-4, second term in 112 Gordon Hall. Professors Neish and Goodwin.

CHEMISTRY 73—Industrial Chemistry. Short Course.

For students in Courses A, E, F, fourth year.

A short lecture course adapted to students in Mining, Mechanical and Civil Engineering. Topics such as the rusting of iron and its preservation, hard and soft waters, paints, lubricants, explosives, and cements.

Texts—Leighou, *Chemistry of Materials.*
Bulletins of Bureau of Mines.

Lecture—Wednesday, at 10, in 105, Gordon Hall, Professor Goodwin.

Chemistry 171—Advanced Industrial Chemistry.

For students in Course B, fourth year—first term.

This course deals with the following subjects:—Distillation and dephlegmation, wood distillation, alcohol, acetic acid, acetone. Dissolution, decantation, filtration, centrifugals. Manufacture of organic nitro compounds and explosives, cyanamide, ammonia. Equilibrium and optimum conditions for contact sulphuric acid and synthetic ammonia processes, absorption of gases by liquids and solids, absorption and reaction towers. electric furnace products and synthetic acetone, potash manufacture and recovery, recovery of waste acids, ceramics, films, sulphite, sulphate and mechanical wood pulp, paper.

Texts—References to Library.
Partington, *Sulphuric Acid.*
Lectures—Monday and Friday, at 11, in 105 Gordon Hall.
Laboratory—Monday, 1-4, in 112 Gordon Hall. Professor Goodwin.

Chemistry 271.—Industrial Chemistry (Research Training).

For graduate students and students in Course B, fourth year, electing thesis option in Industrial Chemistry. Professors Neish and Goodwin.

Reports and Essays.

In the third and fourth years of Course B, Reports and Essays will play a very important part in the training of a Chemist. A graduate in Chemistry should be able to use the library, as it is one of the most important tools of the profession, and to this end he should be able to read Scientific German and French.

The work will consist of written reports on assigned topics. Third year, Monday, 10-11, Wednesday, 4-5, the second term. Fourth year, the equivalent of two hours per week throughout the year.

GEOLOGY.

Professor—M. B. Baker, B.A., B.Sc., F.G.S.A.

Assistant Professor—B. Rose, B.Sc., Ph.D., F.G.S.A.

The Geological and Mineralogical Museum, situated on the ground floor of Ontario Hall, is equipped with splendid collections of minerals ,ores, rocks and fossils, classified and systematically arranged to illustrate most of

the subjects treated of in lectures. This is a section of the work in which the co-operation of the mining public is invited, and all donations to this museum will be kept and credited to the donor.

The various courses in Geology, described in some detail below, are intended to equip the professional geologist, the mining engineer, the civil engineer requiring a knowledge of the relative merits of natural construction material. The classes are open to Arts students as well as to those of the engineering professions. Graduates or others wishing to investigate a special geological problem will have all possible facilities in the way of laboratories and apparatus at their disposal.

GEOLOGY I

For students in courses A, B, C, and D.

ELEMENTARY GEOLOGY. Students taking this class must have passed in Chemistry I.

An introductory course in general Geology is given preparatory for those students who proceed to a more advanced course in Geology or Mining, and at the same time a more or less complete, though elementary, course for those who do not pursue the subject any farther.

The following subjects will be treated of in the lectures: The Atmosphere; the Hydrosphere; the Lithosphere; the probable nature of the Earth's interior; the general characters and classifications of rocks; volcanic action; earthquakes; upheaval and subsidance; glaciation; the geological effects produced by heat, pressure, water; bosses; dykes; veins; stratification; dip and strike; anticline and syncline; faults; foliation; the nature and uses of fossils; stratigraphical geology, and an outline of the history of the Earth.

During the month of October excursions will be conducted to places of geological interest in the vicinity of Kingston. Students in Geology and Mineralogy are required to take part in these excursions.

Lectures—Tuesday and Thursday, 9-10. Professor M. B. Baker.

Text-book: Norton, *Elements of Geology.*

GEOLOGY II

For third year students in course C.

STRUCTURAL, DYNAMICAL, AND PHYSIOGRAPHICAL GEOLOGY. Before taking this class students must have passed in Geology I.

The principles of gradation, deformation, faulting, mountain formation, and vulcanism are covered in a more general and a more advanced way

than in Geology I. Attention is also given to the origin of the Earth; the metamorphic cycle; types of marine and continental sedimentation; an introduction to paleontology, physiography, map reading and interpretation.

Lectures—Monday, Wednesday and Friday, 9-10. Professor Rose.
Text-book: Chamberlin and Salisbury, *Introductory Geology.*

GEOLOGY III.

For students in Courses A and C.

ELEMENTARY PETROGRAPHY. Students must have passed in Geology I, and in Mineralogy III.

This course is essentially on igneous geology and petrography, and will consist of lectures on the use of the petrographical microscope and accessories in the determination of rock-forming minerals, and on the determination of some of the more common igneous rocks by both microscopic and field tests. This will be followed by lectures and discussion on the geological occurrences of igneous rocks, the processes of crystalization from magmas, the forms assumed, the textures, and the metamorphic changes that are produced in the mass itself and on its surroundings. The lectures will be supplemented by laboratory work on hand specimens and rock slices.

Lectures—Tuesday, 10-11, and *Thursday,* 10-11, second term.
Professor M. B. Baker.

Laboratory class two hours per week, second term, in groups to be arranged. Professor Baker.

Text-books:

Pirsson, *Rocks and Rock Minerals.*

Luquer, *Minerals in Rock Sections.*

GEOLOGY V.

For fourth year students in Courses A. and C.

GEOLOGY OF CANADA. Before taking this class, students must have passed in Geology I.

In this course special attention will be given to Stratigraphical Geology, and the distribution of the various rock formations in Canada. The topography as well as the structural make-up of the Dominion is studied. The climatic and economic differences of the various portions of Canada are explained.

Lecture—Thursday, 11-12 second term Professor M. B. Baker.

GEOLOGY VI

For fourth year students in Course C.

Historical Geology... After a brief study of the various types of sedimentary formations and the principles of paleogeography, the history of the North American continent is taken up with supplementary references to the other continents when desirable. Emphasis is laid on Canadian occurrences. A number of the more important fossils of each period are studied, and their recognition on sight required. Brief consideration is also given to the history of the Science of Geology.

Lectures—Tuesday, 3-4; *Friday,* 10-11. Professor Rose.

Text-book—Chamberlin & Salsbury, *College Geology.*

GEOLOGY VII.

For fourth year students in Course C.

Advanced Petrography. A course of lectures will be given on the microscopic characters and classification of igneous rocks, and on their general field characters, origin and classification. The lecture work will be supplemented by assigned special reading and by laboratory work with both hand specimens and microscopic slides. Special attention will also be paid to the metamorphic rocks.

Lecture—Tuesday, 1-3. Professor Baker.

GEOLOGY VIII

For fourth year students in Courses A. and C.

Economic Geology. This class treats of the principles of ore deposition. For this purpose type deposits in the largest producing districts throughout the world are studied in some detail. It is, of course, impossible to treat of all products, but the basis of classification and the fundamental principles underlying economic deposits are studied with particular reference to iron, copper, nickel, zinc, lead, silver, gold, aluminium, peat coal, gas, oil, salt, abrasive and refractory materials. A few lectures on building stone as well as on clays and the manufacture of clay products will be given.

Lecture—Monday, 10-11; *Wednesday,* 11-12; *Tuesday,* 11-12 (b).
Professor M. B. Baker.

GEOLOGY IX

For third year students in Course E.

Engineering Geology. This course is intended for students in Civil Engineering, and after a brief introduction to geology, will treat of the occurrence, composition, texture, structure and alterations of rocks, with special reference to their effects on the workability or removal of the rocks in excavation, and in the selection of raw material in construction work. There will also be lectures on clay-products and the selection of building

materials, and an outline of the manufacture of bricks, fire-proof blocks, terra-cotta, roofing-tile, sewer-pipe, and drainage-tile, will be given. Physiography and drainage will also be studied, and a brief discussion of the principles of economic geology.

Lectures—Wednesday, 9-10, *Friday*, 11-12. Professor M. B. Baker.

Text-book—Rees & Watson, ***Engineering Geology.***

GEOLOGY X

For students in Course C.

Field and Laboratory Geology. The laboratory exercises in this course are designed to illustrate by means of specimens, models, photographs, maps and sections, the principal original and secondary structures of rock; the origin and mode of occurrence of rocks in the earth's crust, their cycles of alteration and change; their interpretation and representation in geological surveys.

The field work comprises observations upon the weathering of rocks; shore phenomena; glacial phenomena; igneous and sedimentary rocks; faulting; folds; joints; cleavage; schistosity. Practice in methods of surveying and geological mapping and construction of sections; measuring the thickness of strata and determining the relative ages of geological structures, and the preparation of a map to scale.

Two working hours per week will be arranged to suit the class at the beginning of the first term.

Field Work—Monday, 2-5

Professor Rose.

MINERALOGY.

Professor—E. L. Bruce, B.Sc., A.M., Ph.D., F.G.S.A.

Assistant Professor—B. Rose, B.Sc., Ph. D. F.G.S.A.

The work in this department is intended for students taking the courses in (1) Mining and Metallurgical Engineering, (2) Chemistry, (3) Mineralogy and Geology, and (4) Chemical and Metallurgical Engineering.

It consists of six sections, viz.: Mineralogy I., II., III., IV., V. and VI.

Students in Course A take section I. in the second year and section III. and IV. in the third year.

Students in Course C take section I. in the second year, sections II., III., IV., and V. in the third year, and section VI. in the fourth year.

Students in Course B take section I. in the second year and section IV in the third year.

Students in Course D take section I in the second year.

MINERALOGY I

ELEMENTARY MINERALOGY. The work in this class is intended as a preparation for those entering upon the studies of geology, petrography, mining and metallurgy. The class should be taken in the second session, after the Chemistry and Physics of the first session, as a knowledge of Chemistry and Physics is necessary for a proper comprehension of the subject. The regular work consists of (1) a course of lectures and demonstrations on crystallography at the beginning of the fall term, (2) illustrated lectures on the physical, optical and other properties of minerals, (3) the description of about sixty prominent Canadian minerals, (4) practical work in the determination of these by means of the blowpipe and field tests, (5) excursions during October and November for field work. Students are urged to make use of the museum in the basement, and of the study room provided for them in the Mineralogical department.

Each student is supplied for the session with a locked cabinet and collection of minerals for which he is held responsible. The practical work of the class is conducted in the mineralogical and blowpipe laboratory, where cabinets containing specimens of commonly occurring minerals are arranged for use. Students are taught to recognize minerals by simple field tests, such as form, color, streak, hardness, specific gravity, etc. For this work students must provide themselves with pocket-lens, knife, streak-plate and magnet, and must supply their own blowpipe apparatus.

Saturday Excursions.

Lecture—Wednesday, 10. Professor Bruce.

Blowpipe Class—Monday, 3-5.

Text-books: Ford, *Dana's Text-book of Mineralogy* (Wiley and Sonsè, 1922.)

Ford, *Dana's Manual of Mineralogy.*

Books of Reference:

Crosby, *Tables for the Determination of Minerals.*
Eakle, *Tables.*
Moses & Parsons, *Mineralogy, Crystallography and Blowpipe Analysis,* 5th Ed.
Brush & Penfield, *Manual of Determinative Mineralogy and Blowpipe Analysis,* 17th Ed., 1912 (Wiley & Sons).

Books from the Department Library and from the Professor's private library may be obtained from the Professor

MINERALOGY II.

SYSTEMATIC MINERALOGY. The work of this class is intended for those taking course C.

The regular work consists of a course of lectures, two hours per week, dealing with the physical and other properties of minerals, illustrated by specimens from the lecture cabinet, microscopic slides, thin sections, models, charts and lantern slides. Essays on prescribed subjects are required.

Lectures—Wednesday, 8-9; *Friday,* 10-11; 2nd term. Professor Bruce.

Text-books—Dana, *Text-book of Mineralogy,* 1922. (Wiley & Sons).

Books of Reference:

Miers, *Mineralogy.*
Tschermak, *Mineralogie.*
Bramus, *Mineralreich.*

MINERALOGY III

OPTICAL MINERALOGY. The work of this class is intended for those students only who are taking Course A, Mining Engineering, and Course C, Mineralogy and Geology. It is preparatory to the classes of petrography and determinative mineralogy, which should be taken during the session following. The lectures treat of light and the optical properties of minerals. Reflection, diffusion, refraction, dispersion, polarization, absorption, color, etc., are described and illustrated by the use of the lantern and projection apparatus.

Lectures—Wednesday, 8-9; *Thursday,* 10-11, first term. Professor Bruce.

Text-book: Dana, *Text-book of Mineralogy,* 1922. (Wiley & Sons).

MINERALOGY IV

For students in Courses A, B, and C.

DESCRIPTIVE AND DETERMINATIVE MINERALOGY. The work of this class consists in the exhibition and description of the mineral specimens contained in the several museum collections, special attention being given to ores, gangue-minerals, those having a commercial value and those of importance as rock-forming minerals in geology. By field tests and the use of the blowpipe and the petrographic microscope, practice is obtained in the determination of minerals. Cabinets furnished with specimens of minerals from various parts of the world are supplied for students' use. The number of specimens is being constantly increased by collection, donation, exchange and purchase, the aim being to make the collection as complete as possible.

Lecture—Wednesday, 1-2; *Laboratory, Wednesday,* 2-4. Dr. Rose.

Text-book: Dana, *Text-book of Mineralogy,* 1922. (Wiley & Sons).
Brush & Penfield, *Manual of Determinative Mineralogy and Blowpipe Analysis,* 17th Ed., 1912. (Wiley & Sons).

MINERALOGY V

Advanced Descriptive and Determinative Mineralogy. This is a lecture and laboratory class dealing with the rarer mineral species. It is intended for students specializing in Mineralogy and Geology.

Lecture—*Friday,* 1-3. Professor Bruce.

MINERALOGY VI

Mineral Technology. A course of lectures, illustrated by specimens and lantern slides, supplemented by demonstrations in the museum showing the occurrence and industrial uses of minerals and mineral products.

The following mineral products will be treated: Abrasives, Refractories, Glazes, Ceramic Ware, Lime, Cement, Plaster, Fertilizers, Pigments, Insulators, Gems, Building Stones, etc.

Lecture—Tuesday, 9-10; *Thursday,* 9-10. Professor Bruce.

Books of Reference:

Publications of the Geological Survey of Canada.
Publications of the Mines Branch, Department of Mines, Canada.
Publications of the United States Geological Survey.

Research and Thesis—Students wishing to undertake the research work and thesis of the fourth year under the Department of Mineralogy should consult with the instructors not later than the beginning of their fourth year with regard to research subjects and hours.

MINING ENGINEERING.

Professor—S. N. Graham, B.Sc.

Demonstrator—B. J. Walsh, B. M. Sc.

Mining I.

For students in Course A, third year.

Prospecting. Methods used in pospecting for lode, placer and coal mines. Location, laws, and requirements, of mineral prospects and their examination.

Development of Prospects. The early workings of mines, with a consideration of the many factors entering into the proving up of mineral bodies as commercial quantities.

Boring. The use of long distance drills for prospecting, and for reaching fluids. The rotary Diamond drill, and the percussion drills; their fields of operation and relative merits.

Excavation. The tools and machines used in breaking and removing rock. Also hand and power drilling to place explosive. The common mining explosives; their uses and operation.

Mining Methods. A consideration of the main factors in developing a mine. The sinking of shafts; driving of tunnels, etc. The stoping or winning of minerals from the vein or ore body.

Lectures—Wednesday, 11-2; *Monday,* 9-10, second term.

Laboratory—Tuesday, 9-10. first term.

Professor Graham.

Books of Reference:

Peele, *Mining Engineers' Handbook.*
Hoove, *Principles of Mining.*

Mining II.

For students in Course A, fourth year.

Placer Mining. Consideration of alluvial deposits and their origin: placer mining proper, hydraulic placer, and gold dredging.

Supports. Various forms of timbering or supporting a mine's passages, and stope excavations. The timbers used. Costs and alternative methods; causes of decay in timbers and their preservation. The use of iron and masonry.

Transporation. The handling of material underground, by chutes, cars, and hoists; rope and locomotive haulage. Surface transportation by road, rope, and railway. Loading, unloading, and terminal arrangements.

Hoisting. Head frames, ropes, and drums; various systems which balance the load to some extent or give a steady load on the engines.: Hoisting of ore. Safety appliances and signalling.

Drainage. Sources of water, drainage by tunnels; hoisting of water; use of pumps, and principal types for light and heavy work. Bulkheads.

Ventilating. Natural and artificial conditions which demand ventilation. Methods of ventilating metal and coal mines. Gases of a coal mine. Fans, and distribution of air in coal mines.

Lighting. Use and place of candles, lamps, and safety lamps.

Accidents.. Principles of Employment.

Mine Examination and Valuation.

Students' Papers. These are hour and half hour talks upon observations from experience in the field.

Lectures—Monday, 11-12; *Tuesday.* 1-2; *Thursday.* 11-12, first term and *Thursday,* 10-11, second term. Professor Graham.

Books of Reference:

Peele, *Mining Engineers' Handbook.*
Hoove, *Principles of Mining.*
Young, *Elements of Mining.*
Finlay, *Cost of Mining.*
Storms, *Timbering and Mining.*
McGarraugh, *Mine Book-keeping.*

Mining III.

For students in Course A, fourth year.

The first term work includes practice and problems in Mine Surveying, also the reduction and plotting of a mine survey

In the second term these hours are given to furnace and metallurgical work and to any subject suitable to the course, as a subject for designing, for example, the designing of mill, smelter, surface plant of a mine.

Monday and Wednesday, 1-4. Professors Drury, MacKay and Graham.

Mining IV.

For students courses C and Dm.. fourth year.

This is a course of lectures briefly discussing the formation of ore-bodies, their development and exploitation, the machinery and equipment required, and the sampling and valuation of mining properties. It is intended to link up the work of the geologist and metallurgist with the mine.

Lectures—Monday 1-2 and *Tuesday,* 11-12; first term.
Professor Graham.

Summer Essay.

For students in course A, fourth year.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

The subject title must be given before the end of October. and the essay handed in before the end of the first term. Essays requiring revision must be returned before the spring examinations begin.

All essays must be type-written and suitably bound.

Ore Dressing.

For students in Courses A, C, Dm., third year, Dc., fourth year.

These lectures follow quite closely the subject as taken up in Richards' Text-book of Ore Dressing. They follow the sequence of operations from the arrival of crude ore or mill-rock at the mill until it leaves as a concentrate or bullion. Miscellaneous processes such as magnetic separation, flotation air processes, and coal washing, are discussed separately.

The chief features of this subject are to teach the principles and operations of rock crushing and grinding, stamp milling with amalgamation screening and sizing of crushed ore, classification of sands and slime by water, as a preparation for the separation of minerals by jigs, tables, and other devices of proved efficiency.

Lectures—Thursday, 8-9; *Tuesday,* 11-12, second term.

Laboratory—Thursday, 11-12, second term.

Professor Graham.

Books of Reference:

Richards, *Text-book on Ore Dressing.*
Peele, *Mining Engineers' Handbook.*
Wiard, *The Theory and Practice of Ore Dressing.*
McGraw, *The Flotation Process.*

Milling.

For students course A and Dm., fourth year.

The machinery in the Mill is in most cases of standard sizes and the ores treated are in sufficient quantities to give results which are about the same as commercial practice would give. The uses of the Mill and Laboratories are to furnish training and illustration, to experiment with various processes, and to give help at very reasonable rates to those who are seeking some method of treatment. The ores received are sufficient in quantity and variety to illustrate most of the usual methods of treatment found in actual practice. The work is divided into three main portions.

Laboratory—Friday, 8-4; *Saturday,* 9-12.

Professors MacKay and Graham.

The Mining and Metallurgical Laboratories.

These are equipped for the testing of ores in small lots from various mining districts.

The equipment of the mill as it stands at present consists of the following:—10 in. by 7 in. Blake jaw crusher; 16 in. crushing rolls; 5 stamp battery, 850 lbs., stamps with automatic feeder; 10 in. cone grinder; No. 0 Krupp Ball Mill; impact screen; ;inlet discharge classifier;

vertical line classifier; U-tube classifier for slimes; perforated board-classifier for slimes; cone classifier for 8-foot Callow tank; pipe classifier; 3 compartment spitzkasten; 3 compartment Hartz jig; miniature Hortz jig; 1 Vezin jig; 4 ft. Frue Vanner; Wilfly table (riffle washer); Plato-O table; 8 foot callow tank; Wetherell magnetic concentrator; Ball-Norton magnetic separator; Kingston magnetic separator, dry or wet; Behrend dry concentrator; ;Sturtevant exhauster and blower; Heald and Sisco centrifugal pump; Frenier and Sons' spiral sand pump; Cazin water-motor; Northey mine pump; centrifugal machine for slime treatment; Johnston filter press for slime treatment; Ingersoll-Sergeant rock drill; Mac Machine Company's balanced valve rock drill; Rand rock drill; tripods for rock drill; drifting column for rock drill; Jackson's hand power rock drill; barrel chlorination plant; experimental cyanide apparatus with an air agitator and vacuum filter; Case Laboratory flotation machine; Wood flotation machine.

The Mining and Milling Laboratories.

With the exception of the work given in the Mining and Milling Laboratories all the work in the Department of Mining and Metallurgy is given in Nicol Hall. In the basement of the building there are a large number of furnaces and four laboratories. On the first and second floors are the lecture rooms, draughting room and library.

The Metallurgical laboratory is well equipped with furnaces which may be classed as follows:—

One large blast-furnace (40" by 24") with a bag-house (16 bags); one large roasting furnace (10" by 4') with three charging doors; one Monarch oil furnace for obtaining temperature up to 1400°C.; one Hoskins electric resistance furnace for temperatures up to 1700°C.; one vacuum electric furnace; two tubular electrical furnaces; six gas muffle-furnaces and eight gasoline furnaces.

In the rear of the basement there is a sampling room with power and hand grinding machines and apparatus for preparing the necessary samples for the assay laboratories.

The greater part of the eastern half of the basement is devoted to fire assaying. These laboratories are equipped with fluxing and balance tables; basoline crucible furnace; gasoline, gas, and oil muffle furnaces; and accessory apparatus.

A separate balance room is fitted with assay and chemical balances to be used in connection with the fire assaying and the chemical work carried out in the two front rooms. The latter laboratories will accommodate the final year students in Mining and Metallurgy, and be used in conjunction with the Milling and Metallurgical laboratory work.

A small room in front is fitted with electrolytic assaying.

The western half of the basement is devoted to Metallurgical laboratories and is equipped with electric furnaces, blast furnaces, roasting furnaces, etc., and with sufficient power for extended research work.

The Metallurgy lecture room, second research laboratory, cloakrooms, etc., are on the first floor; and the Mining lecture room, draughting room and students' library on the second floor.

METALLURGY.

Professor of Metallurgy—G. J. MacKay, B.Sc.

Professor of Electro-Metallurgy and Metallurgical Research — C W. Drury, B.Sc., Ph.D.

Demonstrator—B. J. Walsh, B. Sc.

Metallurgy I.

For students in Courses E, F, and G, third year.

A brief discussion of the physical properties and uses of the common metals. The more important industrial alloys, their composition, properties and uses. Refractory materials. The properties of iron and steel, the effects of impurities and of methods of manufacture and working, and the heat treatment of steel.

Lecture—Wednesday, 11-12 . Professor MacKay.

Metallurgy II

For students in Courses A, B, Dm., third year. C, Dc., fourth year.

Heat, calorimetry and pyrometry. Solid, liquid, and gaseous fuels and the special metallurgical uses of each kind. An introduction to general metallurgy—principles, operations and appliances. The metallurgy of iron and steel.

Lectures—Monday, 11-12; *Wednesday.* 10-11. Professor MacKay.

Text-book—Stoughton, *The Metallurgy of Iron and Steel.*

Metallurgy III

For students in Course Dm., third year.

Metallurgical calculations based on the work covered in Metallurgy II.—heat, calorimentry, and pyrometry; heat balance, iron blast furnace charges, etc.

Class meets *Monday,* 9-10, second term. Professor MacKay.

Metallurgy IV.

For students in Courses A and Dm., fourth year.

The metallurgy of the more common non-ferrous metals—gold, silver,

copper, lead, and zinc. The extraction of these metals from their ores, the refining of the metals, their uses, and the alloys into which they enter.

A consideration of the ordinary methods of recovering nickel, cobalt, tin, arsenic, antimony, etc., from the ores.

Lectures—Monday, 8-9; *Tuesday,* 9-10; *Thursday,* 9-10. Professor MacKay.

Text-book—Gowland, *Metallurgy of the Non-Ferrous Metals.*

Metallurgy v.

For students in Course Dm., fourth year.

Metallurgical calculations related to the work covered in Metallurgy IV. Discussions of metallurgical subjects by the students and the reading and discussion of students' essays.

Class meets *Thursday,* 11-12. Professor MacKay.

Metallurgy vi.

For students in Courses Dm., and G. fourth year.

Electro-metallurgy; introductory course in electro-chemistry followed by the consideration of the electrolytic refining of copper, gold and silver and the electrical smelting of aluminum and iron ores, etc.

Lecture—Wednesday, 10-11, second term. Professor Drury.

Metallurgy vii.

For students in Course Dm. fourth year.

Metallurgical plant design. The calculation of the capacities of units in a plant—agitators, sumps, pipes, launders, pumps, furnaces, converters, etc. Details of equipment. Flow sheets. General layout of plants. Bills of material. Power requirements.

The work will consist largely of individual problems for the library and drafting room.

Class meets *Monday,* 2-4. Professor MacKay.

Metallography.

Introductory course in metallography, including:

(*a*) Explanation and interpretation of equilibrium diagrams.

(*b*) Constitution and structure of some industrial alloys, with special reference to brasses, bronzes, bearing metals and different grades of steel.

Lecture and laboratory work—time to be announced later.

Professor Drury.

Metallurgical Laboratory i. and ii.

Laboratory course dealing with a number of metallurgical operations The following experiments are made by the students attending this course: Determination of calorific power and impurities in coals, desilveri-

zation of lead by the Parke's process, standardization of pyrometers by various methods, determinations of cooling curves, decomposition of sulphates and reduction of oxides.

Electroplating, operation of the blast-furnace and electric furnace, and laboratory work in metallography.

Laboratory—II., *Wednesday,* 1-4, Dm. fourth year. Professor Drury.

Laboratory—I., *Friday,* 1-4, Dc., fourth year. second term,.

Professor MacKay.

SUMMER ESSAY.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

The subject title must be given in by October 15th of the final year, and the essay handed in before the end of the first term of the final year.

FIRE ASSAYING.

Courses A and Dm., third year. Course C, fourth year.

The Laboratory course in fire assaying consists of:

(*a*) A number of experiments to test the action of the different reagents used and slags made in assaying.

(*b*) The determination of lead by fire assay methods.

(*c*) The determination of gold and silver in silicious, oxidized and sulphide ores and mattes.

(*d*) The assay of gold and silver bullion.

Lecture—Saturday. 8-9; *Laboratory,* 9-12, second term.

Professor MacKay.

CHEMICAL ENGINEERING.

PROFESSOR—L. F. Goodwin, A.C.G.I., Ph.D., F.I.C.

CHEMICAL ENGINEERING I.

INDUSTRIAL PROCESSES AND PLANT DESIGN

For fourth year students in Course Dc.

INDUSTRIAL PROCESSES.—A detailed study of apparatus and chemical engineering plant, based on the chemical conditions underlying the processes. The subjects dealt with comprise: distillation and dephlegmation, wood distillation, alcohol, acetic acid, acetone. Dissolution, decantation, filtration, centrifugals. Plant for nitric acid manufacture. Influence of heats of reaction, examples distillation of nitric acid and acetone. Atmospheric nitric acid, synthetic ammonia, sulphuric acid, a study of the equilibria

and optimum conditions involved in their manufacture. Mechanical and chemical wood pulp. The moving of gases, liquids and solids. The measurement of gases and their absorption by liquids and solids. Absorption and reaction towers and their design. Filling materials and considerations governing their action and efficiency. The manufacture of nitro compounds, the concentration of weak acids and the recovery of waste acids.

A collection of industrial products and apparatus is available for demonstration, and visits are paid to chemical works at which attendance is required.

Designing of Chemical Plant. Calculation and exercises in designing chemical apparatus and factories. Furnaces and fuels, evaporators, dryers, waste heat recovery. Considerations underlying the choice of materials of construction, acid proof containers and cements. The design of a nitric acid plant and the evolution of structural details. Manufacturing costs as dependent on cost of plant, raw materials, labour, etc. The general design of a sulphuric acid works.

Lectures—Wednesday, 11 a.m. *Thursday,* 11 a.m. (a), 10 a.m. (b).

Laboratory—Monday, 1-4.

Texts.—Partington, *Manufacture of Sulphuric Acid,* etc.
Assigned Reading from
Davies, *Handbook of Chemical Engineering.*
Lunge, *Sulphuric Acid and Alkali.*
And Original Publications.

Chemical Engineering II.

Laboratory Work and Drawing.

For fourth year students in Course Dc.

The elaboration in the laboratory of the best working conditions for a given chemical process.

The study of technical methods of analysis, including rapid methods, and those involving the use of special apparatus and conditions.

The designing and drawing of parts of a chemical plant, based on experimental results worked out in the laboratory.

The practical work will be divided between the laboratory and the draughting room as is found necessary.

Lecture—Friday, 11-12.

Laboratory—Wednesday, 1-4; *Thursday,* 9-10, *Friday,* 9-11.

Texts.—Assigned reading from Davies' *Chemical Engineering,* Lunge, *Sulphuric Acid and Alkali,* and published papers and pamphlets.

LABORATORY OF CHEMICAL ENGINEERING.

The laboratory is provided with large size models of a ball mill, of steam-jacketed evaporating pans, both plain and porcelain lined and fitted with stirring gear. with a steam-jacketed rectifying column and still, a steam jacketed double effect vacuum evaporator, pump and condenser, a jacketed vacuum shelf dryer, a high pressure acid proof filter, a Sweetland self-dumping filter press, several types of vacuum filters, an ordinary and a high speed centrifuge, and with other technical apparatus.

There is further installed a large reaction tower of earthenware designed for experimental purposes, connected to a fan, ventilating flues and measuring services, and provided with a liquor circulating system and motor driven pump, and with selected types of earthenware filling material.

A portable electric motor is available for power purposes, as well as electric current up to 75 amperes at 17 volts. and 5 kilowatt at 110 volts.

There are also installed balances for the rapid weighing of small and large quantities, together with various types of special analytical apparatus.

The instruction in this laboratory is planned to accustom the student to handle fairly large quantities of material and to become familiar with standard types of technical chemical apparatus, as well as to work out the experimental methods required for attacking a problem, and to translate the laboratory results obtained into practice.

CIVIL ENGINEERING.

PROFESSOR—A Macphail.
PROFESSOR—W. P. Wilgar.
PROFESSOR—W. L. Malcolm.
ASSOCIATE PROFESSOR—D. S. Ellis.

GENERAL ENGINEERING I.

For students in courses A, B, C, D, E, F, G.

This subject embraces the physical properties of materials used in the different branches of engineering and the principles involved in the theory of beams, columns, and structures.

MECHANICS OF MATERIALS.—Resistance and elasticity of materials; stress brick, cement, mortar, and concrete; physical properties of the metals and alloys used in engineering, and concrete; physical properties of the metals and alloys used in engineering, and effects of impurities in them; testing for tensile, compressive and traverse strength.

GRAPHICAL STATICS. Graphical representation of stress; funicular and force polygons; dead and wind loads; graphical methods of determining centres of gravity, shearing and bending moments.

MECHANICS OF MATERIALS.—Resistance and elasticity of materials; stress and strain diagrams; bending and shearing forces; compound stress; deflection of beams; columns and struts; riveted joints; centres of gravity and moments of inertia.

Monday and Friday 10-11. Professor Macphail.

Textbooks:

Malcolm, *Graphic Statics.*
Merriman, *Mechanics of Materials.*

Books of Reference:

Merriman, *Strength of Materials.*
Thurston, *Materials of Construction.*
Merriman and Jacoby, *Roofs and Bridges, Part II.*
Slocum & Hancock, *Strength of Materials.*

GENERAL ENGINEERING II

Required of students in third year of Course E.

GRAPHICAL STATICS. Graphical determination of stresses in roof trusses. trusses, bridges, cranes, earth-works, retaining walls, dams, arches, arched ribs, cantilever and suspension bridges.

MECHANICS OF MATERIALS. Analysis of restrained and continuous beams and columns; torsion of shafts; combined stress; flexure of beams and theorem of three moments; plate and lattice girders and columns; resilience and fatigue of materials; initial and temperature stresses; earthworks, retaining walls and dams; arches and arched ribs; suspension bridges.:

THEORY OF STRUCTURES. Girders, roofs and bridges; selection of types with reference to span, loading, head-room, cost, and other considerations; relative advantages of riveted and pin connections; wind bracing and stiffening trusses; trestles and towers.

Lecture Hours—Tuesday, 9-11. Professor Macphail.

Textbooks—Malcolm, *Graphic Statics.*
Merriman, *Mechanics of Materials.*

Books of Feference:

Slocum & Hancock, *Strength of Materials.*
Bovey, *Theory of Structures.*
Merriman and Jacoby, *Roofs and Bridges, Parts, I., II., III.*

GENERAL ENGINEERING III.

Required of students in third year of Courses, A, D, E, F. G.

This course consists of practical work in the drafting rooms, mechanical, electrical, and testing laboratories. Its object is to give the student a knowledge of the practical application of the fundamental principles of engineering in general.

Routine tests of cement, lime, mortar, brick, stone, timber, iron, steel, etc. Specific gravity, fineness, tensile and compressive, strength of cement, etc.

HYDRAULIC MEASUREMENTS

Measurement of mechanical power by means of indicators, dynamometers, etc. Simple experiments in thermodynamic laboratory.

Measurement of electrical power. Simple tests of motors and generators. General electrical measurements.

Laboratory—Monday, 1-4.

Profs. Macphail, Arkley, Jemmett and Rutledge.

GENERAL ENGINEERING IV.

Required of students in the fourth year of Course E.

Independent work in the testing laboratories.

Laboratory—Saturday, 10-12, first term. Professor Macphail.

GENERAL ENGINEERING V.

Required of students in the third year of Courses A, D, F, G.

A combined course of lectures, laboratory work and designing covering the same subjects as in General Engineering II.

Wednesday, 9-10; draughting room, *Friday,* 2-4. Professor Masphail.

Text books—Same as for General Engineering II.

GENERAL ENGINEERING VI.

Required of students in the third year of Course E.

Graphical Representation. Representation of engineering formulae and data. Progress and cost diagrams, interpretation of diagrams, solution of problems by means of diagrams.

Graphical Statics. Continuation of work in General Engineering II., with relation to roofs, bridges, arches and other structures. Practical work in draughting room.

Lecture—Friday, 9-10.

Draughting Room—Thursday, 1-4.

Professor Malcolm

Text—Malcolm's *Graphical Statics.*

STRUCTURAL ENGINEERING I.

Required of students of the third year in Course E.

The work of this class comprises lectures and draughting room work in design of buildings.

In the draughting room students are required to design and detail roofs and other parts of buildings, treating wood, reinforced concrete and steel as their materials of construction..

Lecture—Wednesday, 10-11.

Draughting—Friday, 1-4; *Saturday*—10-12. Professor Wilgar

Text-book—Hool & Johnson's *Concrete Engineers' Handbook.*

Books of Reference—*Ketchum Structural Engineers Hand Book.*

STRUCTURAL ENGINEERING II.

Required of students in the fourth year of Course E.

Foundation of bridges. buildings and other structures, open wells, coffer dams, caissons, substructure types and designs, estimation of quantities and costs from drawings.

Lecture—Tuesday, 11-12.

Draughting Room—Tuesday, 1-4. Professor Wilgar.

Text-book—Jacoby and Davis, *Foundations of Bridges and Buildings.*LLL

Books of Reference—Patton's *Foundations.*
Baker, *Masonry Construction.*
Fowler, *Subaqueous Foundations.*

STRUCTURAL ENGINEERING III.

Required of Students in Course D, fourth year.

Design of Structures. Roofs. Simple roofs in wood and steel. Foundations. Reinforced concrete. Design of structures essential for Chemical Engineers.

Lecture—Tuesday, 9-10.

Draughting—Tuesday, 1-4. Professor Macphail.

Text-book—*Steel Hand-book.*

Books of Reference—Jacoby, *Framed Structures.*
Ketchum, *Structural Engineer's Hand-book.*
Hool & Johnson, *Concrete Engineer's Hand-book.*

STRUCTURAL ENGINEERING IV.

Required of students of the fourth year of Course D.

Design of Structures. Lectures comprise the design of details in steel bridge trusses and other structures.

Projects will be given to the class in Bridge Design according to Standard Specifications, usually consisting of riveted truss, pin-connected truss, etc. Complete stress sheets, working drawings, estimates, etc., being required.

Lecture—Friday, 9-10.
Draughting Room—Wednesday, 1-4.
Friday, 10-12. Professor Macphail.

Text-books—Ketchum, *Structural Engineer's Handbook.*
Steel Hand-book.

Books of Reference—Merriman and Jacoby, *Roofs and Bridges, Pts. I.-IV.*
Waddell, *Bridge Engineering.*

HYDRAULIC ENGINEERING I.

Required of students in third year of courses A, D, E, F, G.

Application of hydrostatic pressure in the case of dams, gates and pipes. Flow of water and measurement of its volume by various orifices and weirs. Flow in open channels, ditches, flumes, etc., and the use and application of these conductors of waters. Flow through tubes and pipes. Use of pipes as conductors of supply for domestic and power purposes. Dynamic and static pressure as applied to motors for power purposes. The study of various water wheels, turbines, etc.

Experiments to cover above principles,
Lectures—Thursday, 9-11, E, F, G. *Friday,* 11-12, 1-2, A. D.
Professor Ellis.

HYDRAULIC ENGINEERING II

Required of students in fourth year in courses E and G.

Comprises the study of hydrography; design and construction of dams and appendages; measurement, development and transmission of water-power; design of hydraulic power plants.

Problems and laboratory work in relation to these subjects.

Lecture hours—*Tuesday,* 8-10. Prof. Ellis.

HYDRAULIC ENGINEERING III

Required of students in fourth year in Courses E and G.

Work in Hydraulic Laboratory or selected experiments dealing with, hydrostatic pressure, orifice, and weir flaw, flow hrough pipes and open channels. Loss in valves and pipe fittings. Efficiency tests an centrifugae pumps, and reaction and impulse turbine. Investigation of flow in draght tube. Social studies as apportunity offers.

Laboratory—Saturday, 10-12.
Course G.—1st term.
Course E.—2nd term. Professor Ellis.

RAILWAY ENGINEERING I

Required of students of the third year in Course E.

The work of this class comprises the study of economics of railway location, estimation of traffic, effects of distance, rise and fall, curvature, on costs of operation.

The proper location of a railway; economic selection of alternative routes; turnouts; crossings; Mass diagram; overhaul; estimation of costs of construction.

Lectures—Monday, 11-12; *Friday,* 10-11, first term.

Field Work and Draughting Room—Wednesday, 1-4 Professor Wilgar.

Text-book—Webb, *Railroad Construction.*

Book of Reference—Wellington's *Railway Location.*

RAILWAY ENGINEERING II

Required of students of the fourth year in Course E.

A course in Railway Construction. Practical methods and costs of grading. Track laying, ballasting, etc. Types, designs, and methods of construction of timber trestles, box and arch culverts. Concrete and reinforced concrete in railway structures.

Lecture—Wednesday, 11-12.

Draughting Room—Friday, 1-3. Professor Wilgar.

Books of Reference—Gillette, *Cost Data;* Webb, *Railroad Construction;* Hool and Johnson, *Concrete Engineers' Hand-book.*

RAILWAY ENGINEERING III

Required of students of the fourth year in Course E.

This course comprises a discussion of Railway organization, maintenance of way and structures, yards and terminals, and block signalling.

Draughting Room—Thursday, 2-4. Professor Wilgar.

Lectures—Thursday, 1-2.

Text—Webb, *Railroad Construction.*

Books of Reference—Orrock's *Structures and Estimates,* Tratmen, *Railway Track and Track Works.*

ENGINEERING ECONOMICS.

Required of students of the fourth year of Course E.

Valuation of public utilities, depreciation, amortization, government control of public utilities as exemplied by the. Railway Act. Specifications Engineering ethics. Economics. Selection of structures and plant.

Students will undertake periodical lectures on any chosen subject in this course.

Lecture—Thursday, 11-12. Professor Wilgar.

Books of Reference—Mead, *Contracts, Specifications and Engineering Relations,* Gillette and Dana. *Construction Cost Keeping and Management.*

MUNICIPAL ENGINEERING I.

Required of third year students in Course E.

Discussion of Municipal Problems.

Monday, 9-10; *Tuesday,* 8-9,; *Thursday,* 8-9, second term.

Professor Malcolm

MUNICIPAL ENGINEERING II.

Required of fourth year students in Course E.

Water Supply. Municipal water supply. Rainfall. Source of supply. Quantity, quality and purification of water. Distribution, designing and details of construction. Domestic systems.

Lecture—Monday, 11-12.

Professor Malcolm.

Text-book—Turneaure and Russell, *Public Water Supplies.*

MUNICIPAL ENGINEERING III.

Required of fourth year students in Course E.

The Collection and Disposal of Sewage and Refuse.

Sewage. The various systems of collection and removal of sewage. Design. Consideration of rainfall, run off, and water consumption. Proportioning of size. Grades and flow in sewers. Methods of construction and materials used. Plumbing. Maintenance of sewer systems, including ventilation, flushing, and inspection. Assessments.

Sewage Disposal. Methods employed, Design, construction, and maintenance of the various systems, including bacterial treatment.

Refuse Disposal. Kinds of refuse. Methods of collection and disposal and economic value of same. Incinerators.

Text-book—Metcalfe & Eddy, *Sewerage and Sewage Disposal.*

Books of Reference—Metcalfe & Eddy, *American Sewerage Treatise. Vols. I. II and III.*

Babbit, *Sewerage and Sewage Treatment.*

Lecture—Monday, 10-11.

Professor Malcolm.

NOTE

Work in Municipal Engineering II. and III and Highway Engineering has been arranged for one period of three hours per week, *Monday,* 1-4. Projects in water works, sewer designs, etc., are set and completed during these hours. As far as possible each student will be given separate problems. A time limit is set on each problem.

HIGHWAY ENGINEERING.

Country and city roads and pavements. Lay out, grades, and roadbeds. Various kinds of pavements and methods of construction. Cost and durability. Gutters, curbs, and gullies. Various kinds of walks, methods of construction, materials used. Method of dust prevention. Construction with street railway track. Methods of assessment. Conduit systems, and lighting of streets.

Projects in highway work are set under actual conditions for survey design and estimate.

Electric Railways. Trackwork, including construction in paving, power supply, cars and car types, factors entering into economics of construction and operation.

Lecture—Thursday, 9-10. Professor Malcolm.

Text-book—Agg, *Construction of Roads and Pavements.*

Books of Reference—*American Highway Engineers Handbook.*
Baker, *Roads and Pavements.*
Blanchard and Drowne, *Highway Construction.*

SURVEYING.

All branches of Surveying receive full consideration. During the outdoor instruction students are given every opportunity to become familiar with the instruments. Notes of all field work are plotted in the draughting-room, and the rules and regulations for field work and instruments-room must be strictly adhered to. Students must be engaged in the work of a class in the hours set apart for it, otherwise their attendance will not be counted. Attendance and character of work done will be considered in the class standing.

SURVEYING I.

Required of all first year students.

The description, use, adjustment and care of chains, tapes, compasses, levels, transsits and minor surveying equipment. Methods employed in elementary surverying.

The practical work in the field and draughting rooms is an important part of this course.

Lecture—Field Work, Thursday, 1-3. Professor D. S. Ellis.

SURVEYING II.

Required of second year students in Courses E, F, F.

It continues the work of Surveying I., and includes Railroad Surveying—Curves, curve problems in location, levelling, profiles, elements of switch-work: Topographic Surveying—with stadia, plane table, hand level, and

transit and level; Reconnaissance and simple triangulation; Hydrographic Surveying—Methods, sextant, river surveying, stream flow; Laying out of buildings and engineering construction.

Lecture—Thursday, 11-12.

Field and Draughting Room—Wednesday, 1-4. Professor Malcolm.

SURVEYING III.

Required of second year students in Courses A, B, C, and D.

It will continue the work of surveying I. Brief courses in the following will be covered: (1) Railroad Surveying, simple curves, simple turnouts, frogs and switches. Profile and vertical curves. (2) Topographic Surveying—Stadia, plane table, hand-level. (3) Hydrographic Surveying—Sextant, soundings, stream flow. (4.) Reconnaisance—Simple Triangulation. (5) Earthwork. (6) Layout of engineering structures.

Lectures—Thursday, 10-11.

Draughting Room—Friday, 1-4. Professor Malcolm.

SURVEYING IV.

Required of third year students in Course E.

Dominion Land Surveying—Comprising the methods adopted in Survey of Dominion Lands, as laid down in Manual of Survey, issued 1918, by the Dominion Government. Provincial Land Surveying.

Geodesy.—Comprising the principles and methods of procedure in extended triangulation. Determination of Latitude, Azimuth, and Time. Angular Levelling.

Mine Surveying.—Principles involved in Mine Surveys, and problems connected with underground work.

Practice. Advanced practical work in Land, Municipal, Mining and Construction Surveying will be given. Problems will be set on Earthwork, Location and Lay-out of buildings. Description of Properties.

Lecture—Tuesday, 11-12.

Field Work and Draughting—Tuesday, 1-4. Professor Ellis.

Text-book—Johnson and Smith, *Surveying.*

Books of Reference—Surveys Act, Ontario.

Manual of Survey for D.L.S.

SURVEYING V.

Required of third year students in Courses A and C.

Dominion Land Surveying, comprising the methods adopted in Survey of Dominion Lands as laid down in Manuel of Survey, issued 1918 by the Dominion Government. Determination of Latitude, Azimuth and Time.

Ontario Land Surveying.

MINE SURVEYING. Principles involved in Mine Surveys and problems connected with underground work.

Topographic Surveying—Extension of work taken in Surveying III.

Lecture—Friday, 10-11, first term.

Field Work—First term only; *Saturday,* 9-12. Professor Malcolm.

Text-book—Johnston and Smith, *Surveying.*

Books of Reference—Surveys Act—Ontario.

Manual of Survey, D.L.S.

ELECTRICAL ENGINEERING.

ASSOCIATE PROFESSOR—D. M. Jemmett, M.A., B.Sc.

LECTURER—J. W. Bain, B.Sc.

DEMONSTRATORS—D. G. Geiger, B.Sc., W. K. Detlor, B.Sc.

ELECTRICAL ENGINEERING I.

FUNDAMENTAL PRINCIPLES.

For third year students in Courses A, D, E and F.

The electric circuit. The magnetic circuit. Generated and induced electro-motive forces. Self and mutual induction. Elementary theory of alternating and direct current generators and motors. Common systems of transmission and distribution of electric current. General principles of illumination. Storage batteries.

Lectures—Monday, 10-11; *first term; Monday,* 10-11, *Friday,* 10-11, *second term.*

Laboratory—See General Engineering III. Professor Jemmett.

ELECTRICAL ENGINEERING II.

For third year students in Courses G and H.

Alternating currents. Laws governing the flow of current in circuits containing resistance, inductance and condensance. The use of the complex quantity. The theory, construction and operation of the transformer. Meters and the measurement of electrical quantities.

Lectures—Tuesday, 9-10; *Saturday,* 9-10. Professor Jemmett.

Laboratory—Saturday, 10-12. Professor Jemmett and Mr. Detlor.

ELECTRICAL ENGINEERING III.

For third year students in Course G.

The electric and magnetic circuits, hysteresis and hysteresis loss. Measurement of magnetic quantities. Some simple transients. Theory of direct current generators and motors. Series shunt and compound machines. Energy losses, efficiency and commutation, methods of control, Storage batteries. Application of direct current in commercial work. Illumination and photometry.

Lectures—Monday, 10-11; *Tuesday,* 10-11; *Friday,* 1-2, first term.
Friday, 11-12, second term. Mr. Bain.

Laboratory—Tuesday, 1-4. Mr. Bain and Mr. Geiger.

ELECTRICAL ENGINEERING V.

For fourth year students in Course G.

Theory of alternating current generators, Synchronous and Asynchronous Motors. Rotary Converters. Potential Regulators. Phase changing. Multiphase Systems. Transmission of power. Applications of alternating current in commercial work.

Lectures—Tuesday, 10-11; *Wednesday,* 11-12; *Thursday,* 10-11; *Friday,* 11-12. Professor Jemmett.

Laboratory—Thursday, 1-4, first term; *Wednesday,* 1-4, second term; *Friday,* 1-4, Professor Jemmett and Mr. Detlor.

ELECTRICAL ENGINEERING VII.

A special course for fourth year students in Course F.

Lecture—Thursday, 1-2. Mr. Bain.

Laboratory—Thursday, 2-4. Mr. Bain and Mr. Detlor.

ELECTRICAL ENGINEERING VIII.

For Fourth year students in Courses G. and H.

Exact solution of transmission lines in the steady state. The general differential equation. Solution in hyperbolic functions. Free, grounded and loaded lines. Nominal and Equivalent π and T lines. Use of complex circular and hyperbolic tables and charts.

Lecture—Wednesday, 10-11, first term *Friday,* 9-10, second term.

Laboratory—Tuesday, 1-4. Professor Jemmett.

ELECTRICAL ENGINEERING IX.

Advantages and Disadvantages of Electric Traction. Electric Motors available for Traction Work. Motor Cars and Electric Locomotives. Methods of Control. Comparison of Characteristics of Steam and Electric Loco-

motives. Power required for various classes of service. Brakes and Braking. Transmission and Distribution of Power for Traction Purposes.

Lectures—Thursday, 11-12.

Laboratory—Monday, 1-4. Professor Jemmett.

ELECTRICAL ENGINEERING X.

For fourth year students in Course G.

Design and Calculation of performance of transformers, generators, and motors.

Lecture—Thursday, 11-12.

Draughting Room—Monday, 1-4. Professor Jemmett and Mr. Bain.

ELECTRICAL ENGINEERING XI.

For fourth year students in Course G.

The Morse System. Repeaters. Duplex and Multiplex Systems. Combination Systems. Automatic and Printing Telegraph. Railway Block Systems. Modern Telephone Systems. Wireless Telegraphy and Telephony. Simultaneous Telegraphy and Telephony.

Lecture—Thursday, 11-12.

Laboratory—Monday, 1-4. Mr. Bain.

Electrical Engineering Laboratories.

Laboratories Nos. 1, 2 and 3 are equipped with standard types of direct and alternating current machines which include sychronous motors and generators, rotary converters, polyphase induction motors, repulsion and compensated induction motors, constant current transformers, series and potential transformers, power transformers, direct current shunt, series and compound wound machines. A complete set of rheostats and brakes with all necessary meters are available for determining the performance of these machines.

Laboratory No. 4, is equipped with standard resistances, electro dynamometers and voltmeters for calibration purposes. Voltages up to 750 volts and current up to 800 amperes are available through two motor generator sets, Watthour, power factor, demand and graphic meters are available for study and calibration.

Laboratory No. 5 is a small room occupied by the Wireless Club.

Laboratory No. 6 contains the experimental transmitting station 9 B.T. There is also a receiving set of very flexible design. This laboratory in addition to being a Radio laboratory is used for the study of the characteristics of electron tubes as generators oscillators and amplifiers. A number of tubes with the necessary variable condensers, reactors, A and B batteries, and

wavemeter are available. Direct current up to 2500 volts and 0.25 amperes is provided for plate voltages..

Laboratory No. 7 is fitted with a photometer and standard lamps. A Duddell oscillograph is available for the determination of wave forms and transient phenomena.

Power is available from the University Plant at 220/110 volts D.C. direct or through a motor—double current generator set which delivers power at 120/60 volts D.C. and 2 phase 85 volts 25 cycles A.C. A 125 volt, 500 ampere hour storage battery and city power at 3 phase 220/110 volts 60 cycles are also provided.

A large number of circuits which have terminals in the various laboratories enable power to be easily transferred from any machine to any other machine.

This laboratory is also equipped with a complete outfit of wireless apparatus, a central telephone exchange, together with a variety of telephone transmitters and receivers.

The University Power Plant is a combination direct and alternating current system making available for study and observation such apparatus as D.C. generators, synchronous motors, Tirril regulators, balancer sets, storage batteries, power transformers, integrating wattmeters, boosters, switchboard apparatus, etc.

The city of Kingston has a new and up to date hydro-electric station, to which visits are made for instruction and observation.

MECHANICAL ENGINEERING.

PROFESSOR—L. M. Arkley, M.Sc.

ASSISTANT PROFESSOR—L M. Rutledge, B.A., Sc.

MECHANICAL ENGINEERING I.

ELEMENTS OF MACHINE DESIGN.

Required of third year students in Courses F, and G; also Course D, for first term only.

The work in this class comprises a study of the following:— Characteristics of materials used in machine construction; a review of the principles of simple stress and bending moments, their application to beams, columns and machine fixtures; principles governing design, selection of working stresses; and horizontal and vertical shear and compound stress; distribution of stress in machine parts; analysis of stress and design of fixtures; for example, rivetted connections, bolts, nuts, screws, keys, cotters and pins;

analysis of stress in simple shafting, crank shafts on two bearings; shaft couplings; miscellaneous problems of design, i.e., design of wall brackets, bases and frames for machinery; bearings; graphical solutions applicable in design, i.e., Mohr's Method of determining the position of the Centre of Gravity and Moment of Inertia of a complex section; study of manufacturing and machine processes as applied to the manufacture of machinery.

Lectures—Tuesday, 11-12; *Friday,* 9-10. Professor Rutledge.

Text Books, *Leutwiler's Machine Design,* Marks, *Mechanical Engineer's Handbook.*

MECHANICAL ENGINEERING II.

TRANSMISSION OF POWER IN MACHINERY.

Required of students in third year in Courses F, and G.

The work in this class consists of analysis of stress in and design of power transmission systems, comprising belt, rope, chain and gear drives; study of couplings, friction clutches and brakes.

Lectures—Monday, 9-10; *Thursday,* 11-12; *second term only.*

Professor Rutledge.

Text book, Leutwiler's *Machine Design;* Leutwiler's *Text of Problems,* Mark's *Mechanical Handbook.*

MECHANICAL ENGINEERING III.

PRATICAL MACHINE DESIGN.

Required of students in the third year in courses F and D.

This course is a practical application of work taken up in Mechanical Engineering I. and II., which courses are prerequisites of the course Mechanical III.

Draughting Room—Course F., Wednesday, 1-4, *Thursday,* 1-4.
Course D., Wednesday, 1-4; *first term only.*

Professor Rutledge

MECHANICAL ENGINEERING IV.

THE ELEMENTS OF THE POWER PLANT.

Required of third year students in Course F., and fourth year students in Courses A, D and E.

This course covers the following:—Fuels and combustion; transfer of heat; heating surface; generation of steam; types of boilers; chimneys; artificial draft; smoke prevention; mechanical stoking; coal handling; use of superheated steam; feedwater heaters; condensing systems; pumping machinery; compressed air; gas and oil engines; gas producers.

Lectures—Tuesday, 10-11, A, D, E, F;
Wednesday, 10-11, F. (a); *Thursday,* 10-11, A. D. E. (a).

Professor Arkley.

MECHANICAL ENGINEERING V.

Advanced Machine Design.

Required of fourth year students in Course F.

This course consists of a more rigorous treatment of the elements of Machine Design and a more intensive study of simple and compound stress. The effect of curvature of stress lines is studied and applied to the design of curved beams, crane hooks, punch press frames; the study of stress in crank shafts is continued and applied to multiple cylinder crank shafts with more than two bearings.

The following subjects are treated fully:—Eccentric loading in various forms; the forces acting on moving parts in machinery including frictional forces involving the study of kinetics; analysis of stress in automobile parts and in machine tools; analysis of stress in a member which does not consist of one homogenous material; design of helical, spiral and leaf springs; lubrication and lubricating oils; bearings of all types; flywheels; interaction of motor and flywheel in a flywheel drive.

Jigs, dies and fixtures design. This part of the course treats of the fundamental principles of tool design and the application of the principles; heat treatment of steel from a mechanical engineering standpoint.

Lectures—Tuesday, 10-11, *Wednesday,* 8-9, 11-12, *Thursday,* 10-11.
Professor Rutledge.

Laboratory—Tuesday, 1-4, *Saturday,* 9-12.
Professor Rutledge and Demonstrator.

Text books—Reference Books in Mechanical Library and Technical Journals.

MECHANICAL ENGINEERING VI.

Design of Power Plants, Heating, Ventilating and Refrigeration.

Required of fourth year students in Course F.

This course deals with the following:—The proportioning and selection of elements and their combination in steam power plants to obtain the maximum profit from investment and operation. Theoretical and practical principles governing the design and operation of gas producer plants. Power plant testing methods and apparatus.

Heat losses from buildings; design of hot air, hot water and steam heating systems. Discussion of refrigeration systems.

Lectures—Thursday, 11-12, *Tuesday,* 9-10, *first term,* Professor Arkley.

Text books—Reference books in Library, Hoffmann's—*Heating and Ventilating.*

MECHANICAL ENGINEERING VII.

PRATICAL MACHINE DESIGN.

Required of third year students in Department G.

This course is a practical application of work taken up in Mechanical I and II which courses are pre-requisites of the course.

Draughting Room—Thursday, 1-4. Professor Rutledge.

MECHANICAL ENGINEERING VIII.

FUEL TESTING.

Required of fourth year students in Course F.

This course covers the following:—

Testing of fuels, gaseous, liquid and solid, with respect of their suitability for power generation. Gas and fuel analysis. Calculation and calorimetric determination of the heating value of fuels. Gas analysis in connection with the operation of steam boilers, gas and gas producers. Physical tests of lubricants. Causes and prevention of boiler scale. Treatment of feedwaters.

MECHANICAL ENGINEERING IX.

KINEMATICS OF MACHINERY.

Required of second year students in Courses E, F, and G.

This course treats of the theory of mechanisms with special attention to the following: The nature of a machine; uniform and variable motions in machines; velocity diagrams, motion diagrams using the phorograph method; applications to various mechanisms found in engines, locomotives and machinery.

The design of gears and cams are treated from first principles including development and design of tooth profiles for cycloidal involute and stub teeth; simple, compound and epicyclic gear trains and proportioning of speeds in machine tools.

Lecture—Tuesday, 9-10.

Draughting Room—Monday, 3-5. Professor Rutledge.

Text Book—*Angus' Theory of Machines.*

MECHANICAL ENGINEERING X.

WORKS ORGANIZATION AND ACCOUNTING.

Required of fourth year students in Courses F and G.

This course treats of the following:—

Works Organization and Accounting; Organization of the staff; functions of the departments, purchasing methods, stock keeping, methods of remunerating labor, distribution of overhead expense and analysis of production charges, elements of factory accounting, depreciation of plant, selection of equipment and organization of staff for highest efficiency.

Lecture—Monday, 11-12 (a); *Tuesday,* 11-12 (a). Professor Arkley.

MECHANICAL ENGINEERING XI.

INTERNAL COMBUSTION ENGINES.

Required of fourth year students in Course F.

This course consists of the design of gas, gasoline and oil engines, suitable for use in automobiles, tractors and stationery engines.

Lecture—Monday, 11-12, *Tuesday,* 11-12, *second term only.*

Text Book—*Internal Combustion Engines,* by Streeter.

Professors Arkley and Rutledge.

THERMODYNAMICS I.

ELEMENTARY THERMODYNAMICS.

Required of third year students in Courses A, D, E, F, and G.

The course consists of a study of the following;—Fundamental laws of Thermodynamics; specific heats; special changes of state, i.e., constant volume, constant pressure, isothermal, adiabotic, polytropic; ideal cycles with perfect gases. Carnot, Stirling and Ericsson cycles; air compression, work and temperatures, maximum economy of compression; thermal properties of saturated vapors and of vapor and liquid mixtures; properties of steam; use of steam tables; miscellaneous type problems on the above.

Lectures—Monday, 9-10, *Thursday,* 11-12; *first term.* Professor Rutledge.

THERMODYNAMICS II.

MECHANICS OF MACHINERY.

Required of third year students in Courses F. and G.

This course furnishes a treatment of the following;—Crank effort and turning moments in steam engines; governors; speed fluctuation in machinery; kinetic energy of machines, including effects of inertia; proper weight of fly wheels; accelerations in machinery and their effects; forces in machines and efficiency of members; graphical constructions; disturbing forces; stresses due to inertia; balancing of machinery.

Lecture—Monday, 11-12, *second term.*

Text Book—*Theory of Machines,* by Angus.

Professor Rutledge.

THERMODYNAMICS III.

ADVANCED THERMODYNAMICS.

Required of fourth year students in Courses F. and G.

This course treats of the following:—Theory of refrigerating machines and systems. Entropy and entropy-temperature diagrams. Superheated steam. Performance of actual engines. Influence of size, speed, valve gear and ratio

of expansion on economy. Steam jackets, Compound and triple expansion engines. Advanced theory of gas and oil engines. Action of steam upon turbine buckets. Flow of steam through nozzles, orifices, and turbine passages, Effects of friction on flow. Types of steam turbines, and their operation.

Lectures—Monday, 10-11; *Thursday,* 9-10.

Professor Arkley and Demonstrator.

Laboratory—First term, Wednesday, 1-4.

Experiments in Thermodynamic Laboratory and local power plants.

THERMODYNAMICS IV.

ADVANCED THERMODYNAMIC LABORATORY WORK.

Required of fourth year students in Course F.

This course consists of advanced engine and power plant testing.

Laboratory—Friday, 9-12, 1-4.

Professor Arkley and Demonstrator.

THERMODYNAMICS V.

VALVE AND VALVE GEARS.

Required of third year students in Course F.

This course consists of a study of the design and action of slide, coreless, piston and poppet valves, etc., valve diagrams; fixed and reversible gears, valve governors, valve operating cams and eccentrics. The lecture work is carried on in conjunction with draughting room exercises and practical valve setting on laboratory apparatus.

Lecture—Friday, 10-11, (a); *Tuesday,* 9-10, (b).

Laboratory—Tuesday, 1-3.

Professor Arkley.

THERMODYNAMICS LABORATORY.

Thermodynamics Laboratories are now divided into two sections, first the Internal Combustion Engine laboratory in Fleming Hall and second, the steam laboratory located at the New Central Heating Plant. The equipment of the former includes a producer gas engine unit complete, a four stroke cycle oil engine, a two stroke cycle gasoline engine, several gasoline engines of different types, and a semi-Diesel Hoag engine and several aeroplane engines.

The steam laboratory proper containing a number of types of steam engine, an air compressor, a condenser and pump, injector testing equipment, etc.

The work in this laboratory is given in connection with the Central Heating Plant where the auxiliary equipment such as steam turbines, centrifugal and reciprocating pumps, water tube and fire tube boilers and feed-water

heaters are all available for study and investigation by the students, they having been designed with this object in view.

A valuable feature in connection with this plant is the study of different methods as carried out from one Central Plant. The whole plant is conveniently equipped for making overal efficiency tests under practical working conditions.

The boilers are equipped with superheaters which makes investigations on the important question of superheated steam possible.

SHOP WORK

INSTRUCTORS—A. C. Baiden, Machine Shop.
W. E. Connolly, Blacksmith Shop.

Required of second year students in Courses E, F, and G., of third year students in Course F., of fourth year students in Course Dc.

To ensure that as many students as possible will have an opportunity to obtain their shop training in commercial works, arrangements have been made with the management of several of the large manufacturing establishments, so that the students who have completed their second year, may enter upon a suitable course of shop training and receive such remuneration as will more than cover their expenses. In this case the student must present a certificate from the manager of the works in which he has carried out his practical work, stating the character of the work done and the amount of time spent in the various departments.

The student must present the certificate to the Professor of Mechanical Engineering who has general supervision over all shop work.

A complete forge shop has been added to the equipment, so that now efficient instruction can be given in machine shop practice, and in blacksmithing. The forge shop is located in the basement of the workshop building, and is equipped with the latest type of downdraft forges, and electric drive for the blower and exhauster.

Students in all courses will be given a course of practical work in workshops of the School as per schedule of courses.

Work Shop—*Thursday,* 1-4, second year courses E, F, and G.
Saturday—9-12, third year course F.
Friday—1-4, fourth year course Dc.

DRAWING.

Assistant Professor—A. Jackson, BSc.

Assistant—E. W. Skinner, A.M.E.I.C.

All drawings are to be drawn in the drafting room assigned. Drawings made by the students are considered the property of the department, and must not be taken from the drafting room until the close of the spring session.

DRAWING I.

Required of all first year students.

The lectures and practical work are arranged with the view of preparing the student for the subject of Engineering Drawing.

Each student at the opening of the term must provide himself wiht a set of drawing instruments of approved standard.

The class standing will be determined by the term's work.

The work will consist of (*a*) Free-hand lettering adapted to working drawings; (*b*) Geometrical Drawing and Simple Working Drawings.

Sections I. and II.—Thursday, 1-3; *Friday,* 1-4. Mr. Skinner.

Text—*Manual of Engineering Drawing*—T. E. French, M.E.

DRAWING II.

Required of second year students in Courses A, B, C, and D.

The work will include structural and machine drawing, making assembled drawings, from detail drawings and from free-hand sketches of details of machines, tracing and blue-printing.

The class standing is determined by the term's work.

Tuesday, 1-3; *Saturday,* 9-12; second term. Professor Jackson.

DRAWING III.

Required of second year students in Courses, E, F, and G.

The class standing is determined by the term's work.

A more extended course than as outlined in Drawing II.

Text—*Manual of Engineering Drawing*—T. E. French, M.E.

Thursday, 9-11; first term; *Tuesday,* 1-3, and *Saturday,* 9-12; second term.

PROJECTION.

A course in the principles of Orthographic, Axonometric and Isometric Projections applying Descriptive Geometry to the representation of the more familiar rectilinear and curvilinear solids, in sections and intersections and the development of their surfaces.

Division of space into four quadrants. Projection of a point in the four quadrants. Representation of infinite planes. Projections of lines on

auxiliary planes. Intersection of planes. Traces of lines and planes. Rotation of points and planes about a fixed axis. True length of a line. Inclination of a plane to the horizontal and vertical planes of projection.

Section I., *Wednesday,* 1-3; Section II., *Monday,* 1-3. Mr. Skinner.

DESCRIPTIVE GEOMETRY.

Required of all second year students.

A continuation of the latter part of the course in Projection. Shortest distance of a point to a line, angle between intersecting lines and planes. Projection of a plane figure in any oblique plane. Intersection of a line and a plane. Perpendicular to a plane. Shortest distance between two lines not in the same plane. Angle between line and plane. Application of Projection principles to the solution of problems in guide pulleys, hip and valley roofs, warped surfaces. Shadows thrown by lines, planes and solids. Shades and shadows of cones, pyramids, etc., on one or more planes. Perspective representation of points, lines and solids.

The students are drilled in the subject by numerous applications in the drafting room.

Tuesday, 1-3, *Saturday,* 9-12, first term, Professor Jackson.

Text-book—Smith's *Practical Descriptive Geometry.*

Students in courses F and G shall enter any commercial works approved by the School and take a special course of shop training extending over a period of thirty-six weeks (18 weeks between second and third, and 18 weeks between third and fourth college years; or, in case accommodation cannot be secured, they shall attend a special course in the workshops of the School, extending over a period of 8 weeks (4 weeks preceding their third college year and 4 weeks preceding their fourth college year).

A student in Course H. shall enter any commercial works approved by the school and take a special course of shop training extending over a period of 12 weeks, between the second and third years of his course.

PHYSICAL TRAINING.

Physical Director—James G. Bews.

Medical Adviser—J. O. Macdonald, M.D.

Each first year student is given a physical examination by the Medical Adviser and corrective exercises in the gymnasium are prescribed when they are needed.

Gymnasium work for two hours each week is required of all first year students except those excused by the Medical Adviser. Voluntary classes are offered other students. The physical drill consists of progressive series of

exercises with dumb bells, Indian clubs, bar bells, and chest weights, combined with marching tactics and free setting-up exercises; also apparatus work on long horse, parallel bars, ladder and horizontal bar.

A wide option is allowed and equivalent credit is given for attendance at gymnastic classes or during active membership on the football, hockey, basketball, or track teams, and in the fencing wrestling and boxing clubs, of the University. Credits is also given to those electing to take C.O.T.C. training in place of regular gymnastic work.

The gymnasium is a modern stone building 60 x 105 ft. and is equipped with lockers, shower-baths, a swimming pool, running track, and all apparatus for physical training.

Hospital Privileges

By regulation of the Senate all students who register in the University must pay a fee of $3.00 towards a health insurance fund which is used by the University to provide medical care for those who are ill.

Athletics

As a member of the Canadian Intercollegiate Amateur Athletic Association, Queen's gives every opportunity for students to compete in intercollegiate athletics on some of the many teams representing the University, while the student who is not a good enough athlete to find a place on a University team has the chance to play in inter-year and inter-faculty games.

All athletic activities are controlled by the Athletic Board of Control, consisting of twelve members—four graduates, four Professors, and four undergraduates. Two of the Professors and the four undergraduate members are elected by the student body. This Board controls the rink, the playing fields, and the gymnasium, and has a supervision and power of veto over the management and expenditure of the rugby, soccer, hockey, basketball, tennis, track, swimming, boxing, fencing, and wrestling clubs.

Through the generosity of Mr. James Richardson, of Kingston and Winnipeg, a graduate in Arts of the University, a new stadium was completed during the summer of 1921. It is situated on the Union Street Campus and is known as the George Richardson Memorial Field. The grand-stand is of steel and concrete construction, containing ample accommodation for players, and seating 2,000 spectators. The bleachers accommodate 1,700. The playing field is unexcelled by any in Canada. Within the stadium is also a cinder track 15 feet wide with a straight-away of 100 yards, 20 yards wide. An additional rugby field will also be built outside the stadium to care for the overflow from the first and second team practices. Soccer is played on the campus in front of the Arts Building.

There has also been erected a new arena with a seating capacity of about 4,000 and containing ample dressing rooms for teams and skaters.

LIBRARIES.

Each department of the Faculty of Science has a departmental library in which the books and periodicals specially related to the subject of the department are kept, and where they can be consulted. There is thus a separate library for physics, chemistry, mining and metallurgy, geology and mineralogy, general and civil engineering, and mechanical and electrical engineering. This arrangement facilitates the consultation of books in the building in which they are most useful. In some cases where a book is much used in more than one department, duplicate copies are provided.

The books are catalogued in card catalogues and numbered in such a way as to be readily accessible. Students have the greatest freedom in the use of books and journals, which they may take home under conditions easily complied with, varying slightly in the different libraries.

Books to which students constantly refer in any one branch of their work are for the most part kept in the laboratory or room in which the work is carried on. For example, books in quantitative chemical analysis which are most frequently consulted are placed on a shelf in a quantitative laboratory.

The library of the geology department receives geological survey reports from Britain and nearly all of the British colonies, from the federal government, and the greater number of the United States, and from several other foreign countries.

Students in Applied Science have access, not only to the departmental libraries, but also to the central library of Queen's University, which contains upwards of 100,000 volumes. Besides the card catalogue of books, there is an extensive card catalogue of important articles in the leading periodicals in the possession of the library.

There are considerably over a hundred periodicals in all the libraries combined.

ENGINEERING SOCIETY.

The representative student organization of the Faculty of Applied Science is the Engineering Society. All students registered in the Faculty of Applied Science are members of this society. Regular monthly meetings are held and the society has been very fortunate, in recent years, in securing successful engineers to address the students during the session. Any student member who wishes to read a scientific paper before the society will always find the executive of the Engineering Society ready and willing to arrange a date. Prizes are offered in connection with such student papers.

There is also the Committee on Athletics which attends to all athletic affairs of the Science students.

The Engineering Society and the graduates and alumni issue annually a publication containing a complete list of all the graduates, and a list of all students registered in the Science Faculty and a record of all matters in connection with the Engineering Society.

An Employment Bureau has been established and a permanent Manager engaged. The objects of the Bureau are to obtain suitable positions for graduates and for students during the summer vacations and to put graduates and employers, engineers, chemists, etc., in touch with each other for their mutual advantage. Communications should be addressed: Manager, Employment Service, Engineering Society, Queen's University.

The Society conducts a Technical Supplies Department, where all books prescribed, stationery, note books, drawing paper and instruments, and all other supplies, may be purchased at prices but slightly over cost. Any books not in stock will be ordered on payment of a small deposit.

THE FIFTH FIELD COMPANY—QUEEN'S ENGINEERS.

In common with all other units of the Canadian militia, the 5th Field Company was disbanded by an order from Headquarters in 1919. The purpose of this was to facilitate the reorganization of the units upon a proper basis.

The 5th Field Company was originally organized in 1910 by Professor A. Macphail, and was recruited from the students of what was then the School of Mining. Under Professor Macphail's leadership this unit soon gained an enviable reputation for efficiency, and for the excellent work which it carried out. During the war it was a recruiting centre for the engineer units of the Canadian Corps, and through the men who went overseas from it, the name of Queen's was made known throughout the British Army.

It was the splendid traditions of the 5th Field Company, together with the appreciation of the fact that every engineering graduate should be also an engineer officer, ready for service if required, that made the members of the Engineering Society of Queen's vote unanimously for the continuance of the unit as an organization of the students of the Faculty of Applied Science.

In connection with the annual training of the Company a school for the training of engineer officers is held so that all those who so desire may take the training and examinations required to qualify for an engineer commission.

During the past year thirty members of the company took the examinations for officer certificates.

The officers of the 5th Field Company for the past year were:

Hon. Colonel—Col. A. Macphail, C.M.G., D.S.O.

O.C.—Lt.-Col. D. S. Ellis, D.S.O.

Captain—Capt. W. P. R. Holdcroft, M.C.

Lieuts—A. Jackson.

H. B. Hanna.

W. E. Affleck.

C. S. M.—E. A. Filmer.

C. Q. M. S.—W. A. Dawson.

SCHOLARSHIPS IN SCIENCE.

Awarded 1922.

First Year Scholarships.

1. The Sir Sandford Fleming Practical Science Scholarship..... $70
   Brown, W. M., Owen Sound, Ontario.
2. The N. F. Dupuis Scholarship $60
   Quance, J. E., Delhi, Ont.
3. The J. B. Carruthers Scholarship $50
   Pasternack, D. S., Calgary, Alta.

Second Year Scholarships.

1. The P. D. Ross No. 1 .....$100
   Stephens, L. E. R., Minden, Ont.
2. The P. D. Ross No. 2 ..... $50
   Furse, G. D., Thamesford, Ont.

Medals.

Governor General's Medal 1920-21—D. O. Notman, St. Catharines, Ont.
Governor General's Medal 1921-22—J. F. Comer, Calgary, Alta.

DEGREES AWARDED IN THE FACULTY OF APPLIED SCIENCE, MAY 1922.

Degree of M.Sc.

Notman, D. O. .....St. Catharines, Ont

Degree of B.Sc.

(*Honour Standing)

Name	Course	Address
Bleakney, H. H.	Dm	Ottawa, Ont.
Bulmer, C. E.	F	Cobden, Ont.
Cameron, D. A.	Dc	Orangeville, Ont.
*Clench, R. J.	F	St. Catharines, Ont.
*Comer, J. F.	A	Kingston, Ont.
Cooper, N. C.	B	Orillia, Ont.
Corlett, A. V.	A	Thamesville, Ont.
Deamude, F. V.	E	Dunnville, Ont.
Detlor, W. K.	G	Deseronto, Ont.
Devenny, J. P.	H	Renfrew, Ont.
*Emrey, D. J.	E	Nevis, B. W. I.
Finlay, D. D.	Dm	Carleton Place, Ont.

Frid, C. H.	E	Hamilton, Ont.
Geiger, D. G.	G	Kingston, Ont.
Gerow, C.	Dm	Bloomfield, Ont.
*Gibson, C. S.	A	Kingston, Ont.
Greenwood, W.	E	New Liskeard, Ont.
Hamilton, A. G.	Dc	Kingston, Ont.
Hanlon, J. B.	Dm	Kingston, Ont.
Hanna, J. A.	Dc	Parrsboro, N. S.
Henderson, J. A. H.	E	Ottawa, Ont.
Hewgill, P. F.	A	Kingston, Ont.
*Jacques, A. G.	B	London, Ont.
Lang, A. T.	Dm	Winnipeg, Man.
LaFontaine, W. O.	A	Cornwall, Ont.
Lewis, G. E.	Dc	Camden East, Ont.
*Lord, T. V.	A	Toronto, Ont.
Lyon, R. A.	H	Riverview, Ont.
Maddox, D. C.	C	Glanworth, Ont.
Malone, C. E.	E	Regina, Sask.
Mott, R. C.	A	Belleville, Ont.
*Myers, H. R.	E	Stratford, Ont.
McDonald, R. J.	A	Kingston, Ont.
McDonough, J. E.	A	Haileybury, Ont.
*MacEwan, J. U.	Dm	Martintown, Ont.
McGill, A. K.	A	Glanworth, Ont.
McIlraith, E. F.	Dm	Lanark, Ont.
MacLachlan, A. G.	E	Smyrna, Asia Minor.
McLean, W. A.	Dc	Harrowsmith, Ont .
O'Brian, C. L.	B	L'Original, Ont.
O'Gorman, C. F.	E	Toronto, Ont.
Paoli, A. A.	E	Charlottetown, P. E. I.
Poyser, B. D.	E	Iroquois, Ont.
Roche, J. J.	B	Ottawa, Ont.
Roughton, D. R.	E	Kingston, Ont.
Roy, E. W.	F	Napanee, Ont.
Saunders, J. B.	G	Kingston, Ont.
Searle, H. E.	Dm	Kingston, Ont.
Thorburn, H. B.	Dm	Ottawa, Ont.
Tully, J. D.	E	Calgary, Alta.
Urquhart, M. L.	A	Martintown, Ont.
Van Buskirk, J. E.	Dm	Belleville, Ont.
Walker, G. S.	E	Ottawa, Ont.
Wallace, A. M.	E	Kingston, Ont.
Walsh, B. J.	Dm	Perth, Ont.
Young, J. P.	F	Owen Sound, Ont.

LIST OF STUDENTS

FACULTY OF APPLIED SCIENCE

In Attendance Session 1922-23

FIRST YEAR.

Name	Address
Airth, W. B.	Toronto, Ontario.
Arnold, F. J.	Brantford, Ontario.
Bawden, W.	Kingston, Ontario.
Beaton, W. W.	Haileybury, Ontario.
Boag, E. C.	Ottawa, Ontario.
Bromley, A. W.	Sudbury, Ontario.
Brookins, H.	Ottawa, Ontario.
Brown, H. M.	Carleton Place, Ontario.
Burley, J. G.	Picton, Ontario.
Buss, C. R.	Mill Roches, Ontario.
Clemence, A. Le R.	Bronte, Ont.
Clement, A.	Chapleau, Ontario.
Deeley, H. S.	London, Ontario.
Dunlop, N. R.	Carleton Place, Ontario.
Fell, J. L.	Brampton, Ontario.
Gayman, W. A. R.	St. Catharines, Ontario.
Godwin, R. B.	Ottawa, Ontario.
Hartman, H. J.	Kingston, Ontario.
Haslam, H.	Niagara Falls, Ontario.
Hoover, W. J.	Brussels, Ontario.
Jerome, E.	Cornwall, Ontario.
Johns, C. D.	Allandale, Ontario.
Kilborn, R. K.	Toronto, Ontario.
King, N. H.	Cochrane, Ontario.
Kirk, W. D.	Douglas, Ontario.
LaQue, F. L.	Gananoque, Ontario.
Lundy, C. S.	Newmarket, Ontario.
Marion, L.	Ottawa, Ontario.
Mathieson, T. S.	Beachburg, Ontario.
Moffatt, H. S.	Toronto, Ontario.
Morgan, E. O.	Delhi, Ontario.
Muirhead, A. G.	Carleton Place, Ontario.
McBride, G. C.	Carp, Ontario.
MacLeod, D. R.	Kingston, Jamaica, B. W. I.
MacDonnell, G. F.	Perth, Ontario.

Name	Address
MacKinnon, K. A.	Kingston, Ontario.
McNamee, B. A.	Kingston, Ontario.
Neilson, C. S.	Wilton, Ontario.
Oates, G. L.	Queen's Line, Ontario.
Patterson, R. B.	London, Ontario.
Reed, J. A.	Ottawa, Ontario.
Reid, W.	Kingston, Ontario.
Richards, W. A.	Hamilton, Ontario.
Richardson, G.	Watford, Ontario.
Roney, G. V. L.	Kingston, Ontario.
Rystogi, C .A.	Dawson, Yukon.
Saunders, C. B.	Sarnia, Ontario.
Stephens, C. L.	London, Ontario.
Stewart, H. H.	Kingston, Ontario.
Taylor, A. D.	Beamsville, Ontario.
Traves, J. R.	Elginburg, Ontario.
Urlocker, W. F.	Thorold, Ontario.
Weir, E. B.	Woodstock, Ontario.
White, A. F.	Indian River, Ontario.
Wright, W. E.	Kingston, Ontario.

SECOND YEAR.

Adams, R. C. (D)	Woodstock, Ont.
Brown, W. M. (D)	Owen Sound, Ont.
Burwash, G. O.	Arnprior, Ont.
Cleminson, L.	Sault Ste. Marie, Ont.
Davis, W. (D)	Sudbury. Ont.
Dilworth, E. L.	Medicine Hat, Alta.
Donnelly, W. D. (F)	Kingston, Ont.
Fritzsche, K. W. (A)	Atlin, B.C.
Henderson, G. R. (E)	London, Ont.
Higgins, J. A. (E)	Kemptville, Ont.
Hopkins, A. D. (F)	Hamilton, Ont.
King, J. H. (E)	East Orange, N.J.
Kirkpatrick, R. A. (E)	Edmonton, Alta.
Kurtz, H. J. T. (E)	Burlington, Ont.
LaFlair, J. P. (F)	Kingston, Ont.
Lathey, C. C. (E)	Ottawa, Ont.
Leadley, F. R. (E)	Hamilton, Ont.

Name	Address
Lee, F. S.	Toronto, Ont.
Maybee, G. R. (B)	Kingston, Ont.
Melvin, H. F. (B)	Vars, Ont.
Minter, H. J. D. (G)	Rockcliffe, Ottawa, Ont.
Murphy, C. B. (F)	Marisfield, Ont.
McAteer, L. (F)	Toronto, Ont.
MacGregor, K. R. (G)	Eganville, Ont.
MacLachlan, I. (E)	Smyrna, Turkey.
McIntosh, J. C.	Vankleek Hill, Ont.
Newman, P. M.	Allandale, Ont.
Quance, J. E. (D)	Delhi, Ont.
Pasternack, D. S. (D)	Calgary, Alta.
Roberts, L. P.	Brockville, Ont.
Russell, J. H. (E)	London, Ont.
Skinner, E. W. (F)	Kingston, Ont.
Small, S. W. (B)	Wallacetown, Ont.
Snyder, H. H. (E)	North Bay, Ont.
Strain, A. J.	Renfrew, Ont.
Suffel, G. G. (B)	Irkerman, Ont.
Swartman, G. (A)	Waubaushene, Ont.
Thwaites, J. T. (G)	Hamilton, Ont.
Tumelty, C. F. (G)	Madoc, Ont.
Walli, O. E.	Copper Cliff, Ont.
Warren, T. E. (B)	North Augusta, Ont.
Wells, H. H. (G)	Trois Rivieres, Que.
Willis, R. W. (A)	Listowel, Ont.

THIRD YEAR.

Allan, Clarence	Kingston, Ont.
Appleyard, C. E.	Woodstock, Ont.
Atwell, J.	Brantford, Ont.
Ballard, B.	Monteagle Valley, Ont.
Beattie, R. W.	Owen Sound, Ont.
Bell, J. A.	Schumacher.
Blakely, E. A.	Trenton, Ont.
Boyd, I. W.	Sault Ste. Marie, Ont.
Bronson, E. H.	Brantford, Ont.
Brydon, F. E.	Francis, Sask.
Burns, J. C.	Kingston, Ont.
Campbell, A. J. G.	Trenton, Ont.
Campbell, R. D.	Dalkeith, Ont.

Name	Address
Cardiff, J. C.	Renfrew, Ont.
Cassan, C. S.	Campbellford, Ont.
Chesser, A. M.	Haileybury, Ont.
Cleland, R. W.	Weyburn, Sask.
Cockburn, J. M.	Gravenhurst, Ont
Cole, E. J.	Owen Sound, Ont.
Cox, H.	St. Thomas, Ont.
Cross, D. M.	Listowel, Ont.
Dafoe, A. A.	Francis, Sask.
Davison, C. F.	Halfway River, N.S.
Douglas, J. M.	Kingston, Ont.
Edwards, H. J.	Deseronto, Ont.
Ferguson, J. C.	Admaston, Ont.
Filmer, E. A.	Toronto, Ont.
Forrest, R.	Renfrew, Ont.
Furse, G. N. D.	Thamesford, Ont.
Gilpin, J. J.	Collingwood, Ont.
Gordon, C. W.	Woodlawn, Ont.
Hanna, H. B.	Prescott, Ont.
Harvey, W. M.	New Liskeard, Ont.
Hayes, A. C.	Cannington, Ont.
Heard, C. A.	St. Thomas, Ont.
Henderson, D. A.	Blenheim, Ont.
Henderson, W. A.	Owen Sound, Ont.
Hepburn, D. O.	Stratford, Ont.
Holmes, E. I.	Ottawa, Ont.
Hutchison, D.	Kemble, Ont.
Lewis, D. J.	Ottawa, Ont.
Jarrett, G. S.	Weyburn, Sask.
Knechtel, M. M.	Ottawa, Ont.
Lebeau, A. M.	Toronto, Ont.
Love, G. C.	Kingston, Ont.
Lyons, G. S.	Kingston, Ont.
Murray, G. H.	Mooretown, Ont.
Murray, J. D.	Kingston, Ont.
Murray, R. H.	Mooretown, Ont.
McBean, J. M.	Georgetown, Ont.
McDonald, D.	Winnipeg, Man.
Mackenzie, A. G.	Whycocomagh, N.S.
Mackenzie, H. B.	Toronto, Ont.

Name	Address
MacLeod, J. C.	Dunvegan, Ont.
McNeil, K.	Springfield, Ont.
Macpherson, D.	Kingston, Ont.
North, H. H.	Palmerston, Ont.
Osborne, H. R.	St. George, Ont.
Paterson, J. A. H.	Westmeath, Ont.
Patterson, E. G.	Calgary, Alta.
Patterson, W. E.	Brantford, Ont.
Peal, E. J.	Guelph, Ont.
Philp, L. A.	Lindsay, Ont.
Reynolds, R. S.	Smith's Falls, Ont.
Roberts, F. M.	Stettler, Alta.
Scott, C. W.	Napanee, Ont.
Shipman, G. E.	London, Ont.
Srigley, R. J.	Windsor, Ont.
Stephens, L. E. R.	Campbellford, Ont.
Stewart, G. E.	Renfrew, Ont.
Stewart, H. W.	Owen Sound, Ont.
Stewart, W. J.	Renfrew, Ont.
Taylor, W. A.	Paris, Ont.
Thomas, F. D. D.	Niagara Falls, Ont.
Thompson, M. L.	Hillier, Ont.
Thorn, W. A.	Ottawa, Ont.
Townshend, A. S.	Clinton, Ont.
Walters, W. E.	Owen Sound, Ont.
Whitton, J. B.	Renfrew, Ont.

FOURTH YEAR.

Affleck, W. E.	Dutton, Ont.
Allen, A. J.	Prescott, Ont.
Anderson, L. C.	Cobalt, Ont.
Askin, R. J.	Irma, Alta.
Austin, A. P.	Toronto.
Baker, A. J.	Lakeside, Ontario.
Bastedo, T. F.	485 Vincent St., Woodstock, Ont.
Batzold, H. A.	49 Barnes St., St. Thomas, Ont.
Birchard, W .H.	Aurora, Ont.
Bracken, W. D.	Seeley's Bay, Ont.
Brown, T. A.	529 Gilmour St., Ottawa.
Brown, W. H.	Port Colborne, Ont.
Budgeon, B. H.	66, Curzon St., Toronto.

Name	Address
Burns, R. P.	30 James St., E., Brockville, Ont.
Cameron, D. G.	Carleton Place, Ont.
Campbell, G. G.	North Sydney, C. B.
Carson, O. A.	72 Barrie St., Kingston.
Chalmers, A. E.	14 Lyall Ave., Toronto, Ont.
Chamberlin, L.	Whitewood, Sask.
Chisholm, C. A.	Port Hood, N. S.
Climo, C.	Cobourg, Ont.
Collyer, C. S.	Box 275, London, Ont.
Collyer, E.	Box 275, London, Ont.
Connor, R. Z.	Kitchener, Ont.
Corbett, H. E.	Domville, Ont.
Corneil, F. M.	R. R. No. 3, Omemee, Ont.
Corneil, R. G.	Box 157, Lindsay, Ont.
Coulter, D. L.	86 Gladstone Ave., St. Thomas, Ont.
Couse, H. A. C.	Cookstown, Ont.
Currie, V. R.	Lanark, Ont.
Dawson, W. A.	Barrie, Ont.
Elliott, F. W.	Ingersoll, Ont.
Ennis, L. E.	21 Chatham St., Kingston.
Farquharson, R. J.	Toronto, Ont.
Ferguson, J. G.	Conquest, Sask.
Finkle, C. S.	Ottawa, Ont.
Foster, A. R.	109 Pine St., Sault Ste. Marie, Ont.
Fraser, H. J.	Court House Square, Brockville, Ont
Geiger, D. G.	Kingston, Ont.
Geiger, G. F.	59 Hartley St., Brockville, Ont.
Gibson, J. C.	179 Alfred St., Kingston.
Graham, W. J.	19 Alwington Ave., Portsmouth, Ont.
Griffin, H. S.	157 Main St. E., Hamilton, Ont.
Hambley, W. A.	Box 255, Copper Cliff, Ont.
Hansen, C. A.	Keewaten, Ont.
Hansuld, S. B.	Stratford, Ont.
Harvie, A. C.	Port Colborne, Ont.
Hay, M. N.	Listowel, Ont.
Hicks, A.	R.R. 4, Picton, Ont.
Hipwell, J. E.	Bond Head, Ont.
Holdcroft, W. P. R.	Havelock, Ont.
Holt, E.	Bath, Ont.
Howes, G. A.	Parham, Ont.
Hunter, J. W.	33 Grove St., Welland, Ont.

Name	Address
James, V. A.	90 Harbord St., Toronto, Ont.
Johnston, C. S.	502 Kent St., Ottawa.
Johnston, J. D.	502 Kent St., Ottawa.
Jones, V. C.	Jordan Station, Ont.
Kennedy, T. W.	R.R. No. 1, Ottawa.
Kirkland, J. C.	Almonte, Ont.
Koen, J. D.	Sydenham, Ont.
Lockett, L. W.	23 Sydenham St., Kingston.
Long, C. R.	38 West St., Orillia, Ont.
Lowry, W. S.	Bell's Corners, Ont.
Ludgate, J. V.	Parry Sound, Ont.
Manske, R. H. F.	Macklin, Sask.
Marlatt, C. E.	Trail, B.C.
Maxwell, C.	Vankleek Hill, Ont.
Meathrell, J. N.	Ingersoll, Ont.
Minnes, V. A.	Kensington Ave., Kingston, Ont.
Monteith, A. C.	Powassan, Ont.
Moorhead, L. C.	Carp, Ont.
Morrison, N. A.	R.R. No. 2, Creemore, Ont.
Moulton, R. H.	Coaticook, Que.
McAuley, P. H.	R.R. No. 4, Trenton, Ont.
McClure, J. B.	R.R. No. 2, Thamesford, Ont.
McCrea, J. G. L.	Springtown, Ont.
MacDonald, N. T.	Bala, Ont.
Macgillivray, M. S.	96 Albert St., Kingston, Ont.
MacGregor, H. R.	Owen Sound, Ont.
McIlquham, W. S.	Lanark, Ont.
McIntosh, W.	131 Empire Ave., Port Arthur, Ont.
Mackay, R.	Ingersoll, Ont.
McNeilly, H. K.	62 Emerald St., Hamilton, Ont.
McRory, G. L.	Sydenham, Ont.
Nayler, J. B.	Box 168, Madoc, Ont.
Parsons, G. M.	Arnprior, Ont.
Rapley, B. P.	27 Victor St., London, Ont.
Read, G. W.	R.R. No. 2, Dunrobin, Ont.
Reynolds, W. M.	Box 445, Aurora, Ont.
Robertson, D. G.	82 Wellington St., Kingston, Ont.
Robinson, D. O.	106 Gravel Road, St. Thomas, Ont.
Rose, D. C.	Carleton Place, Ont.
Rousell, F.	Box 84, Paris, Ont.
Rutherford, C.	Burford, Ont.
Salton, G. H.	461 Albert St., Ottawa, Ont.
Salton, H. E.	461 Albert St., Ottawa, Ont.

Saunders, J. B. .....Kingston, Ont.
Schaeffer, J. G. .....Humboldt, Sask.
Showers, C. G. .....R.R. No. 4, St. Mary's, Ont.
Simpson, C. .....Cornwall, Ont.
Smith, A .....R.R. No. 1, Silver Hill, Ont.
Spence, J L. .....Lucknow, Ont.
Stewart, D. W. .....Renfrew, Ont.
Sully, E. A. .....Metcalf, Ont.
Swift, E. R. .....Grimsby East, Ont.
Taggart, H. A. .....Westport, Ont.
Tomkins, J. . .....151 Alfred St., Kingston, Ont.
Veale, F. J. .....161 Nelson St, Kingston, Ont
Vining, W. H. .....Ingersoll, Ont.
Waddington, R. H. .....Toronto, Ont.
Wagar, E. T. .....Napanee, Ont.
Warner, G. W. .....Moosomin, Sask.
Webster, G. B. .....R.R. No. 2, Newmarket, Ont.
Wilson, J. L. .....Charles St. West, Ingersoll, Ont

FIRST YEAR—ALL COURSES

	VIII.	IX.	X.	XI.	I.	II.	III.	IV
Mon.		Chem. I.	Math. Lab.	Phys. I.	Phys. Lab. Sect. 1 Projection Sect. 2	Phys. Lab. Sect. 1 Projection Se ct. 2	Phys. Drill	
Tues.		Math. I.	English	Math II. (a) Math. III. (b)	Chem. I	Chem. I	Chem. I	
Wed.		Chem. I	Math. IV. (a) Astron I. (b)	Phys. II.	Phys. Lab. Sect. 2 Projection Sect. I.	Phys. Lab. Sect. 2 Projection Sect. 1	Phys. Drill	
Thurs.		Math. I (a) Math. II. (b)	English	Math. II. (a) Math. III. (b)	Surv. I.	Surv. I.	Math. Lab.	
Fri.		Chem. I	Math. IV (a) Astron. I. (b)	Phys. II.	Draw. I. Sects. 1-2	Draw. I Sects. 1-2	Draw. I Sects. 1-2	Engineering Society
Sat.		Phys. I	Draw. I. Sects. 1-2	Draw. I. Sects. 1-2				

SECOND YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.		Phys. III.	Genl. I.	Math. V.	Phys. III. A.B.C.D. Chem. 13 E.F.G.(3)	Phys. III. A.B.C.D. Chem. 13. E.F.G. (3)	Min. I. A.B.C.D. Mech. IX. E.F.G.	Min. I. A.B.C.D. Mech. IX. E.F.G.
Tues.		Geol. I. A.B.C.D. Mech. IX. E.F.G.	Math. V (a) Astron. II (b)	Chem. 15. A.B.C.D.	Descr. Geom. (a) Drawing II (b) A.B.C.D. Draw. III (b) E.F.G.	Descr. Geom. (a) Draw. II (b) A.B.C.D. Draw. III (b) E.F.G.	Phys. IV. (b) E.F.G.	Phys. IV. (b) E.F.G.
Wed.		Phys. III.	Min. I. A.B.C.D. Chem. 13 E.F.G.	Math. V.	Chem. 15. A.B.C.D. Surv. II. E.F.G.	Chem. 15. A.B.C.D. Surv. II. E.F.G.	Chem. 15 A.B.C.D. Surv. II. E.F.G.	
Thurs.		Geol. I. A.B.C.D. Drawing III (a) E.F.G.	Surv. III. A.B.C.D. Drawing III (a) E.F.G.	Chem. 15. A.B.C.D. Surv. II. E.F.G.	Chem. 15. A.B.C.D. Shop work E.F.G.	Chem. 15. A.B.C.D. Shop work E.F.G.	Chem. 15 A.B.C.D. Shop work E.F.G.	
Fri.		Phys. III.	Draw. II (b) A.B.C.D. Draw. II. A.B.C.D. Genl. I.	Math. V. (a) Astrom. II (b)	Surv. III. A.B.C.D. Phys. III. E.F.G.	Surv. III. A.B.C.D. Phys. III. E.F.G.	Surv. III. A.B.C.D.	Engineering Society.
Sat.		Descr. Geom. (a) Draw. II (b) A.B.C.D. Draw. III. (b) E.F.G.	Descr. Geom. (a) Draw. II (b) A.B.C.D. Draw. III. (b) E.F.G.	Descr. Geom. (a) Draw. II (b) A.B.C.D. Draw. III. (b) E.F.G.				

Numbers in brackets indicate sections.

THIRD YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.		Therm. I. (a) **A.D.E.F.G.** Chem. 35 **B.** **Mining I.** A. (b) Met. III Dm. (b) Mun. I E (b) Mech. II (b) F.G. Geol. II. C. (a)	Elect. I. **A.D.E.F.** Chem. Reps. B (b) Elect. III. G.	Met. II A.B.Dm. Chem. 21 Dc. Ry. I. E. Math. VI (a) F.G. Therm. II. (b) F.G. Math. VIII., IX. H.	Genl. III. A.D. E.F.G. Chem. 71 B.	Genl. III. A.D. E.F.G. Chem. 71 B.	Genl. III. A.D. E.F.G. Chem. 71 B.	
Tues.	German B.H. Geol. II. C. (b)	Mining I (a) A. Chem. 41 B.C.D. Genl. II. E. Thermo. V. F. (b) **Elect. II.** G.H.	**Geol. III.** **A.C.** Chem. 71 B.D. Genl. II. E. Mech. IV. **F.** Elect, III. **G.** Phys. VI. VII. H.	Ore Dressing (b) A.C.Dm. Mech. I. D. (a) F.G. Surv. IV. E.	Chem. 41 B.C.D. Survey IV. E. Thermo. V. F. **Elect. III.** **G.** Physics VI. (a) H. Physics VII. (b) H.	Chem 41 B.C.D. Survey IV. E. Thermo. V. F. **Elect. III.** **G.** Physics VI. (a) H. Physics VII. (b) H.	Chem. 41 B.C.D. E. Elect. III. **G.** Physics VI. (a) H. Physics VII. (b) H.	Physics VI. (a) H. Physics VII (b) H.
Wed.	Min. III. (a) A.C. **Min. II.** **C.(b)** Elect. III. G. (a)	Chem. 35 B. Geol. II. **C.** Genl. V. A.D.F.G. Geol. IX. E.	Met. II. A.B.Dm. Chem. 21 Dc. (b) Struct. I. E. Mech. IV. F. (a) Math. VII. G. (b) Phys. V (a) G.H. Phys. VIII. H. (b)	Mining I. A. Chem. 21 B.Dc. **Met. I.** E.F.G. Math. VIII. IX. H.	**Min. IV.** A.B.C. Chem. 21 Dc. (b) Mech. III. D.(a) F. Chem. 71 Dm. (b) Ry. I. **E.** Phys. V. G.H.	**Min. IV.** A.B.C. Chem. 21 Dc. (b) **Mech. III.** D. (a) F. Chem. 71 Dm. (b) Ry. I. **E.** Phys. V. G.H.	Min. IV. A.B.C. Chem. 21 Dc. (b) **Mech. III.** D. (a) F. Chem. 71 Dm. (b) Ry. I. E. Phys. V. G.H	Chem. Reps. B. (b) Chem. 21 Dc. (b)

THIRD YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Thurs.	Ore Dressing **A.C.Dm.** **Mun. I.** **E (b)** **German.** **B.H.**	**Chem. 41** **B.C.D.** **Hydr. I.** **E.F.G.**	Min. III (a) A.C. Geol. III (b) A.C. **Chem. 71** **B.D.** **Hydr. I.** **E.F.G.** Phys. VI., VII. **H.**	Thermo. I (a) A.D.E.F.G. Ore Dressing (b) A. C. Dm. **Mech. II.** **F.G. (b)**	Chem. 21 B **Chem. 31** **A.C.D.H.** **Genl. VI.** **E.** **Mech. III.** **F.** **Mech. VII.** **G.**	Chem. 35 B **Chem. 31** A.C.D.H. **Genl. VI.** **E.** **Mech. III.** **F.** **Mech. VII.** **G.**	Chem. 35 B **Chem. 31** A.C.D.H. Gen. VI. E. **Mech. III.** **F.** **Mech. VII.** **G.**	Chem. 35 B. **Chem. 31** A.C.D.H.
Fri.	**Chem. 31** **Dc. (b)**	**Geol. II.** **C.** **Phys. XIV.** **B. (a)** **Chem. 31** **Dc. (b)** **Mech. I.** **D.(a) F.G.** **Genl. VI.** **E.**	Surv. V. (a) A.C. **Min. II.** **C. (b)** **Phys. XIV.** **B. (a)** **Ry. I.** **E.(a)** **Thermo. V.** **F. (a)** **Elect. I. (b)** A.D.E.F. Phys. V. (a) G.H. **Math. VII.** **G. (b)** **Phys. VIII.** **H. (b)**	**Hydr. I.** **A.D.** **Chem. 21** **B.** **Geol. IX.** **E.** Math. VI (a) F.G. **Elect. III.** **G. (b)** **Math. VIII., IX.** **H.**	**Hydr. I.** **A.D.** **Min. V.** **C.** **Chem. 35** **B.** **Struct. I.** **E.**	**Genl. V.** **A.D.F.G.** **Min. V.** **C.** **Chem. 35** **B.** **Struct. I.** **E.**	**Genl. V.** **A.D.F.G.** **Chem. 35** **B.** **Struct. I.** **E.**	**Engineering Society.**
Sat.	Fire Assay (b) A. Dm. **German.** **B.H.**	Surv. V. (a) A.C. Fire Assay (b) A.Dm. Chem. 21 **B.** **Chem. 71** Dc. Dm. (a) **Shop Wk.** **F** **Elect. II.** **G.H.**	Surv. V. (a) A.C. Fire Assay (b) A.Dm. Chem. 21 **B** Chem. 71 Dc. Dm. (a) Struct. I. **E.** Shop Wk. **F.** **Elect. II.** **G.H.**	Surv. V. (a) A.C. Fire Assay (b) A.Dm. Chem. 21 **B.** Chem. 71 Dc. Dm. (a) Struct. I. **E.** **Shop Wk.** **F.** **Elect. II.** **G.H.**				

FOURTH YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.	German (a) B.C. Met. IV. A.Dm.	Econ. I.	Geol. VIII. A.C. Chem. 45 B.D. Mun. III. E. Thermo. III. F.G.	Mining II. A. Chem. 171 (a) 141 (b) B. Met. II. C.Dc. Mun. II. E. Mech. X. (a) F.G. Mech. XI. F (b) Phys. IX., XI., H.	Mining III. A. Chem. 171 (a) 141 (b) B. Chem. Eng. I. Dc. Mining IV C. Dm. Mun. II., III. E. Mech. V. F Elect. X. G. Phys. XIII. H.	Mining III. A. Chem. 171 (a) 141 (b) B. Geol. X. C. Chem. Eng. I. Dc. Met. VII. Dm. Mun. II., III. E. Mech. V. F. Elect. X. G Phys. XIII. H.	Mining III. A. Chem. 171 (a) 141 (b) B. Geol. X. C. Chem. Eng. I. Dc. Met. VII. Dm. Mun. II., III. E. Mech. V. F. Elect. X. G. Phys. XIII. H.	Geol. X. C.
Tues.	Hydraulics II E.G. Math. X & XI. H.	Met. IV. A.Dm. Struct. III. Dc. Hydraulics II E. G. Mech. VI. F. (a) Min. VI. C.	Mech. IV. A.D.E. Chem. 101 B. Biol. II. C. (a) Mech. V. F. Elect. V. G.	Mining IV (a) C.Dm. Geol. VIII (b) A.C. Chem. 121 B. Ore Dressing Dc. (b) Struct. II. E. Mech. X. (a) F.G. Mech. XI. F. (b) Elect. X G. (b) Phys. X., XII. H.	Mining II. A. Chem. Opt. B. Geol. VII. C. Struct. III. Dc. Struct. II. E. Elect. VIII. G.H.	Chem. Opt. B. Geol. VII. C. Struct. III. Dc. Struct. II. E. Elect. VIII. G.H.	Chem. Opt. B. Geol. VI. C. Struct. III. Dc. Struct. II. E. Elect. VIII. G.H.	

FOURTH YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Wed.	German (a) B.C. Mech. V. F.	Econ. I.	Chem. 73 A.E.F. Chem. Reps B. Met. II. C.Dc. Met. VI (b) Dm. G. Elect. X G. (a)	Geol. VIII. A.C. Chem. Reps B. Chem. Eng. I. Dc. Ry. II. E. Mech. V. F. Elect. V. G. Phys. IX., XI. H.	Mining III. A. Chem. 121 B. Chem. Eng. II. Dc. Met. Lab. II. Dm. Geol. Reps. C. Struct. IV. E. Thermo III (a) F.G. Mech. VIII. F. (b) Elect V. G. (b) Phys. XIII. H.	Mining III. A. Chem. 121 B. Chem. Eng. II. Dc. Met. Lab. II. Dm. Geol. Reps. C. Struct. IV. E. Thermo III (a) F.G. Mech. VIII. F. (b) Elect V. G. (b) Phys. XIII. H.	Mining III. A. Chem. 121 B. Chem. Eng. II. Dc. Met. Lab. II. Dm. Geol. VI C. Struct. IV. E. Thermo III (a) F.G. Mech. VIII. F. (b) Elect V. G. (b) Phys. XIII. H.	
Thurs.	Ore Dressing Dc. Math. X., XI. H.	Met. IV. A.Dm. Min. VI. C. Chem. Eng. II. Dc. Highway E. Thermo. III. F.G.	Mech. IV (a) A.D.E. Mining II A (b) Biol. II. C. (a) Chem. 101 B. Chem. Eng. I Dc (b) Mech. V. F. Elect. V. G.	Mining II. A. (a) Geol. V (b) A.C. Met. V. Dm. Chem. 121 B. Chem. Eng. I. Dc. (a) Ore Dressing Dc. (b) Eng. Econ. E. Mech. VI. F. Elect. VI. G. Phys. X,. XII. H.	Geol. Reps. C. Chem. 45 B.D. Ry. III. E. Elect. VII. F. Elect. V. G. (a)	Geol. Reps. C. Chem. 45 B.D. Ry. III. E. Elect. VII. F. Elect. V. G. (a)	Geol. Reps. C. Chem. 45 B.D. Ry. III. E. Elect. VII. F. Elect. V. G. (a)	

FOURTH YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Fri.	Milling A.Dm. Chem. Opt. B (b) German (a) B.C.	Milling A.Dm. Chem. Opt. B. (b) Chem. Eng. II. Dc. Struct. IV. E. Thermo IV. F. Elect. VIII (b) G. H.	Milling A.Dm. Chem. Opt. B. (b) Geol. VI. C. Chem. Eng. II. Dc. Struct. IV. E. Thermo. IV. F. Phys XV (a) G.H.	Milling A.Dm. Chem. 171 (a) 141 (b) B. Chem. Eng. II. Dc. Struct. IV. E. Thermo. IV. F. Elect. V. G.	Milling A.Dm. Chem. 101 (a) B. Chem 106 (b) B. Geol. Reps. C. Met. Lab. I. Dc. (a) Shop Wk. Dc. (a) Ry. II. E. Thermo. IV. F. Elect V. G. Phys. XIII. H.	Milling A.Dm. Chem. 101 (a) B. Chem 106 (b) B. Geol. Reps. C. Met. Lab. I. Dc. (b) Shop Wk. Dc. (a) Ry. II. E. Thermo. IV. F. Elect V. G. Phys. XIII. H.	Milling A.Dm. Chem. 101 (a) B. Chem 106 (b) B. Geol. Reps. C. Met. Lab. I. Dc. (b) Shop Wk. Dc. (a) Thermo IV. F. Elect V. G. Phys. XIII. H.	Engineering Society
Sat.	Chem. 45 B.D. Fire Assay C (b) Math. X., XI. H.	Milling A.Dm. Fire Assay C. (b) Chem. 121 B. Mech. V. F. Phys. XV (a) G. H. Phys XV G.H. (b)	Milling A.Dm. Fire Assay C (b) Chem. 121 B. Genl. IV. E. (a) Mech. V. F. Hydr. III G (a) E (b) Phys. XV G.H. (b)	Milling A.Dm. Fire Assay C (b) Chem. 121 B. Genl. IV. E. (a) Mech. V. F. Hydr. III G (a) E (b) Phys. XV G.H. (b)				

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